East Tarboro Canal Stream Restoration Project
Edgecombe County
North Carolina

EEP Project No. 123
DENR Conrtact No. D08030S
CU: 03020103

Year 5 of 5 Monitoring Report
Data Collection: September through November 2012
Submission Date: November 30, 2012

Prepared for:

North Carolina Department of Environment and Natural Resources
Ecosystem Enhancement Program
217 West Jones Street, Suite 3000A
Raleigh, NC 27603

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Prepared by:

Rummel, Klepper & Kahl, LLP
900 Ridgefield Drive
Suite 350
Raleigh, NC 27609

2.0 Table of Contents

1.0 Title Page i
2.0 Table of Contents ii
3.0 Executive Summary/Project Abstract 1
4.0 Methodology 2
5.0 References 2
6.0 Project Condition and Monitoring Data Appendices 2

Appendix A. Project Vicinity Map and Background Tables
Appendix B. Visual Assessment Data
Appendix C. Vegetation Plot Data
Appendix D. Stream Survey Data
Appendix E. Hydrologic Data

3.0 EXECUTIVE SUMMARY/PROJECT ABSTRACT

Project goals and objectives for the East Tarboro Canal stream restoration project included:

Project goals are:

- Provide a stable stream channel that neither aggrades nor degrades while maintaining its dimension, pattern, and profile with the capacity to transport its watershed's water and sediment load.
- Improve water quality and reduce erosion.
- Improve aquatic habitat with the use of natural material stabilization structures such as root wads, rock vanes, woody debris, and a riparian buffer.
- Provide a native stream buffer that will increase bank stability, improve wildlife habitat, and eliminate or reduce exotic invasive plant infestations and increase the aesthetic value by transforming the unvegetated ditch into a functioning stream buffer.

While project objectives included:

- Restore approximately 2,900 linear feet of East Tarboro Canal.
- Restore the natural riparian buffer.
- Construct a new floodplain at a lower elevation.

Thirteen (13) permanent vegetation plots were established and used in annual vegetation monitoring. The vegetative success criteria are based on the US Army Corps of Engineers Stream Mitigation Guidelines (USACE, 2003) that require 260 stems per acre after five (5) years for stream restoration and 320 stems per acre after five (5) years for buffer restoration. Planted areas on Reach 2 are being monitored for Riparian Buffer Restoration (RBR) assets. This site was instituted prior to October 2007 and, therefore, will generate RBR credit within the conservation easement where planted hardwood stem density requirements are met and a minimum of 50' and a maximum of 200' from top of bank. There are 9.6 acres that are eligible for RBR credit if density requirements are met. Currently, the site is meeting the minimum success requirements for the stream restoration planting and buffer restoration planting accruing 464 stems per acre for SMU and 348 stems per acre for BMU. Although the project received supplemental planting in February 2011 and the site has higher stem counts than previous monitoring years, some areas (VP 4, 12 and 13) are still below BMU crediting criteria and VP 4 is also below SMU minimum criteria.VP1 along with Reach 1 have been removed from the project. The conservation easement, on this portion, has been lifted, and the property has been returned to the Town of Tarboro. Areas along Reach 2 have been subject to beaver impacts resulting in the loss of planted stems. The beaver infestation has caused damage to riparian vegetation along the restored stream channel and dams have cause flooding that could potentially drown planted stems. Vegetation plot locations are identified in Figure 2 along with locations of beaver activity. East Tarboro Canal Stream Restoration Project received supplemental planting during February 2011 resulting in stem counts higher than previous monitoring years.

The restored stream is functioning well and holding grade while maintaining bedform features. Overall the project is performing adequately. However, the stream has two areas of concern that require immediate repair. Channel dimension and pattern are similar to as-built conditions with the exception of bank erosion at station 21+50 and the stream section south of East Wilson Street. Bank erosion at station 21+50 needs stabilization and the beaver dams located throughout the project, but specifically the large dam located in the vicinity of Cross Section 10 (Figure 2), requires immediate removal. The problems associated with beaver infestation have been reported to EEP and remedial action is underway. The damaged stormwater outfall entering Reach 2 between Wilson and St. James streets has been repaired and

is functioning properly. Due to the beaver dam ponding, Cross Sections 9 and 10 were not surveyed nor sampled for a pebble count for MY5 2012. Bankfull events have been recorded onsite during 2012 and can be viewed in Appendix E. (Reach 1 has been removed from the monitoring plan).

Wetland restoration or enhancement was not a part of the East Tarboro Canal Stream Restoration Site. Therefore, no wetland monitoring is required.

Summary information/data related to the occurrence of items such as beaver or encroachment and statistics related to performance of various project and monitoring elements can be found in the tables and figures in the report appendices. Narrative background and supporting information formerly found in these reports can be found in the mitigation and restoration plan documents available on EEP's website. All raw data supporting the tables and figures in the appendices is available from EEP upon request.

4.0 METHODOLOGY

Stream monitoring was completed by utilizing total station survey along with Rosgen Level II techniques to determine stream stability and performance. The annual cross-sectional survey included points surveyed at breaks in slope, bankfull, inner berm, edge of water, and thalweg, if the features were present. Longitudinal profile survey was conducted for the entire length of the restored channel for Reach 2. Measurements included thalweg, water surface, and bankfull. All surveys were complete using existing onsite benchmarks.

Vegetative sample plots were quantitatively monitored during the first growing season. Twelve (12) $100m^2$ plots are used for monitoring. For Monitoring Year 4, 2011, Reach 2 (VP2- VP 13) were sampled. Species composition, density, vigor and survival were monitored. Each plot corner is permanently located with rebar. Year 4 vegetation monitoring was completed in June 2011 utilizing the Carolina Vegetation Survey (CVS) – EEP protocol Level 2 (version 4.1). Baseline data provided was not completed utilizing the CVS-EEP protocol, therefore some data will be skewed.

Photo monitoring was conducted by walking each stream reach and taking photos at each predetermined photo point location using a digital camera.

5.0 References

USACOE (2003). *Stream Mitigation Guidelines*. USACOE, USEPA, NCWRC, NCDENR-DWQ.

USACOE (1987). *Corps of Engineers Wetlands Delineation Manual*. Tech report Y-87-1. AD/A176.

Rosgen, D.L. (1996) *Applied River Morphology*. Wildland Hydrology books, Pagosa Springs, CO.

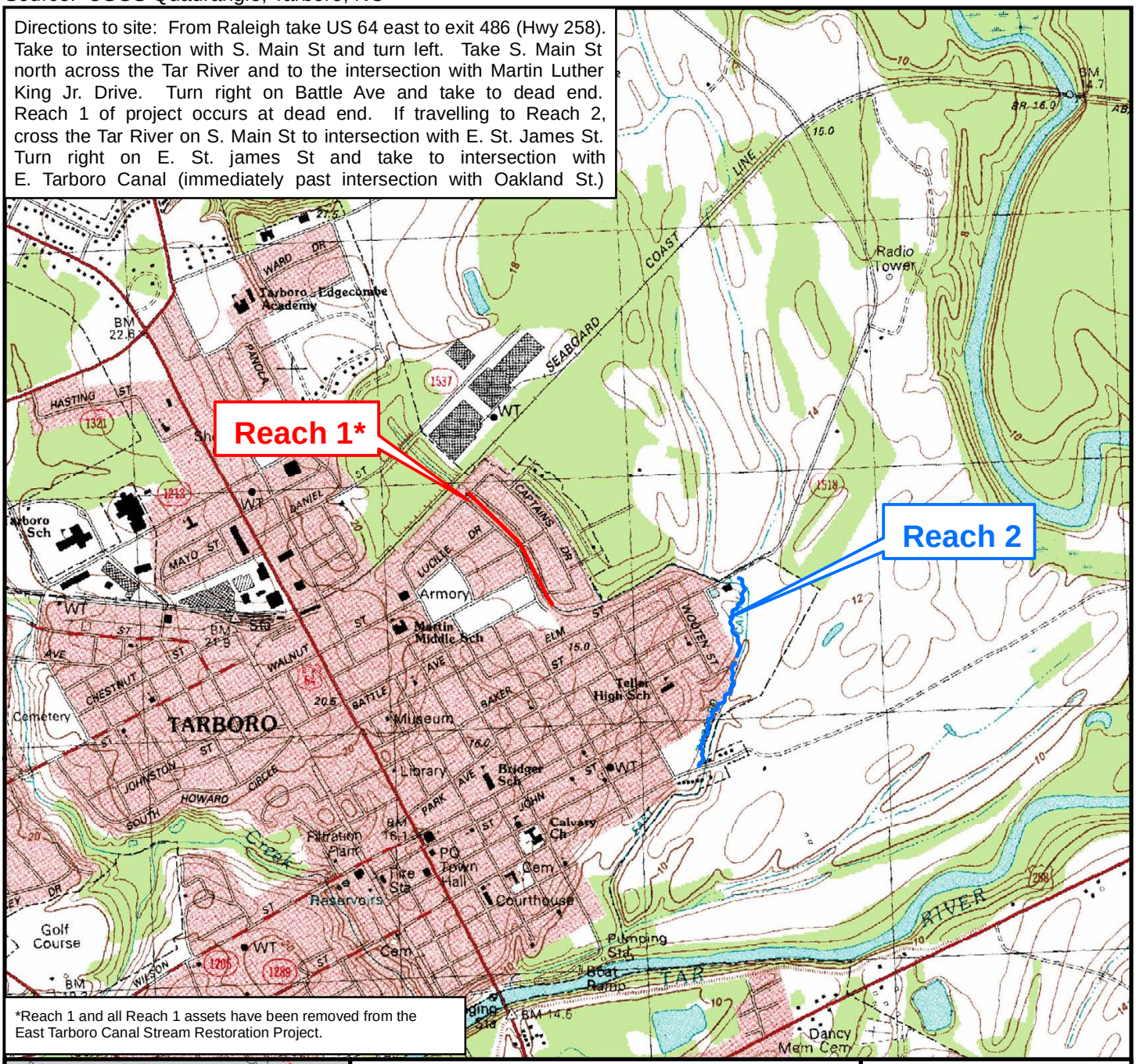
Lee, M.T., R.K. Peet, S.D. Roberts, T.R. Wentworth. (2006). CVS-EEP Protocol for Recording Vegetation Version 4.0

6.0 Project Condition and Monitoring Data Appendices

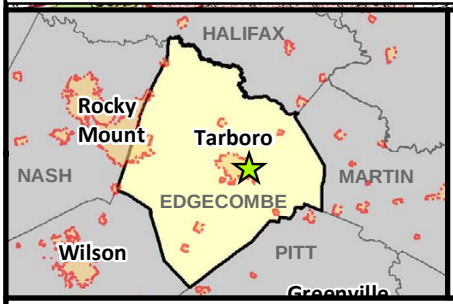
APPENDIX A

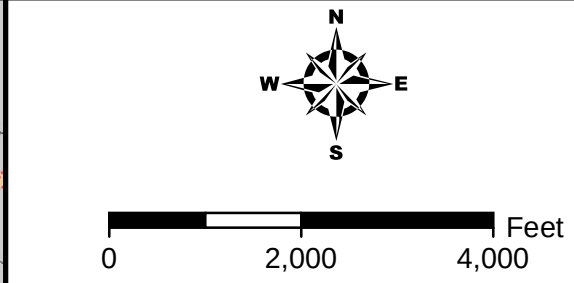
Source: USGS Quadrangle, Tarboro, NC

Directions to site: From Raleigh take US 64 east to exit 486 (Hwy 258). Take to intersection with S. Main St and turn left. Take S. Main St north across the Tar River and to the intersection with Martin Luther King Jr. Drive. Turn right on Battle Ave and take to dead end. Reach 1 of project occurs at dead end. If travelling to Reach 2, cross the Tar River on S. Main St to intersection with E. St. James St. Turn right on E. St. james St and take to intersection with E. Tarboro Canal (immediately past intersection with Oakland St.)



*Reach 1 and all Reach 1 assets have been removed from the East Tarboro Canal Stream Restoration Project.





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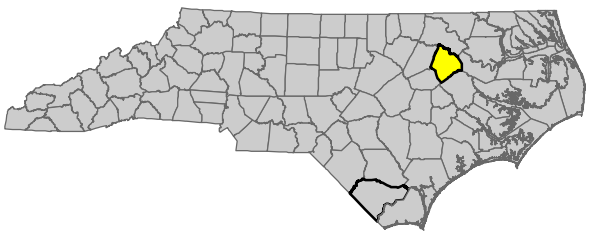

FIGURE 1
Site Location Map
East Tarboro Canal Stream Restoration Project
EEP No. 123
Edgecombe County, North Carolina
November 2012

Table 1. Project Components and Mitigation Credits
East Tarboro Canal, EEP No. 123

Mitigation Credits

	Stream (LF)		Riparian Wetland (acres)		Non-Riparian Wetland (acres)		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals	2,989						418,176 sq. ft.		

Project Components

Project Component	Stationing/Location	Existing Footage/Acreage	Approach	Restoration or Restoration Equivalent	Restoration Footage or Acreage	Mitigation Ratio
Reach 2	10+00 to 39+89		Priority 2		2989 LF	1:1

Component Summation

Restoration Level	Stream (Linear Feet)	Riparian Wetland (acres)	Non-riparian Wetland (acres)	Buffer (acres)	Upland (acres)
Restoration	2,989			418,176 sq. ft	

Table 2. Project Activity and Reporting History
East Tarboro Canal Stream Restoration - EEP Project No. 123

Activity or Report	Data Collection Complete	Actual Completion or Delivery
Restoration Plan	NA	January 2005
Final Design - 90%	NA	May 2005
Construction	Jan 2007	February 2007
Temporary S&E mix applied to entire project area	Jan 2007	Jan 2007
Permanent seed mix applied to entire project area	Jan 2007	Jan 2007
Containerized and B&B plantings	Jan 2007	Jan 2007
Mitigation Plan / As-built (Year 0 Monitoring - baseline)	April 2007	June 2007
Year 1 Monitoring	Nov 2008	Jan 2009
Year 2 Monitoring	Oct 2009	Nov 2009
Year 3 Monitoring	Oct 2010	Nov 2010
Supplemental Planting		February 2011
Year 4 Monitoring	October 2011	November 2011
Year 5 Monitoring	November 2012	November 2012

Table 3. Project Contacts Table East Tarboro Canal Stream Restoration - EEP Project No. 123	
Designer Primary project design POC	Earth Tech 701 Corporate Center Drive Suite 475 Raleigh, NC 27607
Construction Contractor Construction contractor POC	Shamrock Environmental Corporation P.O. Box 14987 Greensboro, NC 27415 Mike Granson (336)-375-1989
Planting Contractor Planting Contractor POC	Shamrock Environmental Corporation P.O. Box 14987 Greensboro, NC 27415 Mike Granson (336)-375-1989
Seeding Contractor Seeding Contractor POC	Shamrock Environmental Corporation P.O. Box 14987 Greensboro, NC 27415 Mike Granson (336)-375-1989
Seed Mix Sources	contact Shamrock Environmental Corporation
   Nursery Stock Suppliers	Mellow Marsh Farm 1312 Woody Store Road Siler City, NC 27344 (919) 742-1200
Monitoring Performers (MY1, MY2, MY3, MY4, MY5)	Rummel, Klepper, and Kahl, LLP 900 Ridgefield Drive Suite 250 Raleigh, NC 27609
Stream Monitoring POC Vegetation Monitoring POC Wetland Monitoring POC	Pete Stafford (919)878-9560 Pete Stafford (919)878-9560 NA

Table 4. Project Baseline Information and Attributes East Tarboro Canal Restoration Site - EEP Project No. 123			
Project Information			
Project Name	East Tarboro Canal		
Project County	Edgecombe		
Project Area	N/A		
Project Coordinates (Lat and Long)	35.907617,-77.5217		
Project Watershed Summary Information			
Physiographic Region	Coastal Plain		
River Basin	Tar		
USGS HUC 8 Digit 03020103	USGS HUC 14 Digit 03020103010010		
NCDWQ Subbasin	030303		
Project Drainage Area	2.78 sq mi		
Project Drainage impervious cover estimate (%)	10 percent		
CGIA Land Use Classification			
Reach Summary Information			
Parameters	Reach 2		
Length of Reach	2,989 LF		
Valley Classification	N/A		
Drainage Area	2.78 sq mi		
NCDWQ Stream Identification Score			
NCDWQ Water Quality Classification	East Tarboro Canal (C, NSW)		
Morphological Description (stream type)	C5		
Evolutionary Trend	N/A		
Underlying Mapped Soils	Roanoke (Ro)		
Drainage Class	Poorly Drained		
Soil Hydric Status	Hydric A		
Slope	.00179		
FEMA Classification	Zone AE		
Native Vegetation Community	N/A		
Percent Composition Exotic Invasive Vegetation	N/A		
Wetland Summary Information			
There are no delineated or restored wetlands as part of this project.			
Regulatory Considerations			
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**
Waters of the United States – Section 404	Yes	Yes	Upon Request
Waters of the United States – Section 401	Yes	Yes	Upon Request
Endangered Species Act	Yes	Yes	Upon Request
Historic Preservation Act	Yes	Yes	Upon Request
Coastal Zone Management Act (CZMA) Coastal Area Management Act (CAMA)	No		
FEMA Floodplain Compliance	Yes	Yes	Upon Request
Essential Fisheries Habitat	No		

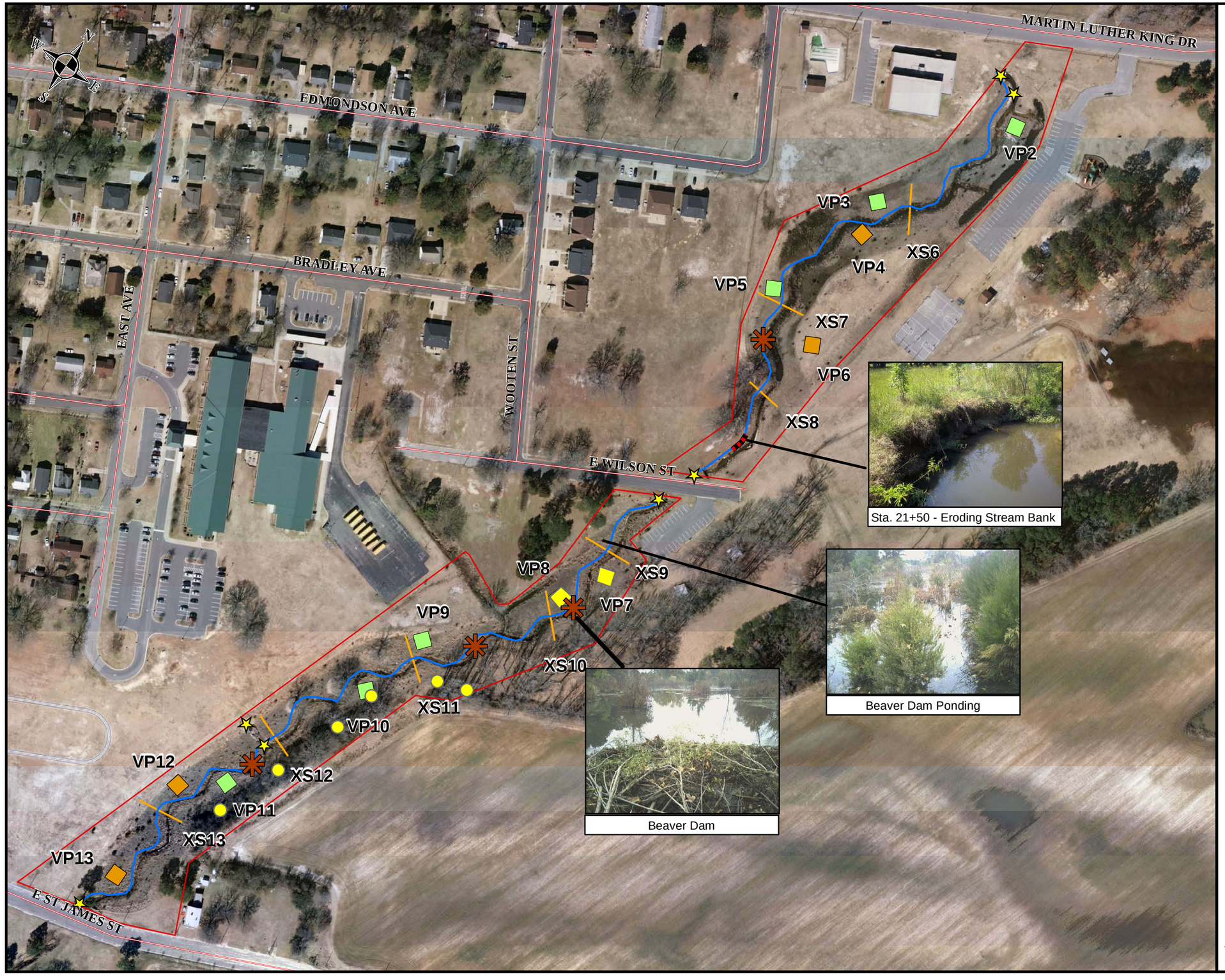

FIGURE 2

Current Conditions Plan View
Reach 2

East Tarboro Canal
Stream Restoration Project
EEP No. 123
Edgecombe County, North Carolina

Legend

- Stream Thalweg
- Cross Section
- Beaver Activity
- Photo Point
- Stream Areas of Concern
- Location of Chinsese privet

Vegetation Monitoring Counts

- Not Meeting Stream or Riparian Buffer Criteria (<260 woody & <320 Hardwood)
- Meeting Stream and Riparian Buffer Criteria (>260 Woody & >320 Hardwood)
- Meeting Stream but not Riparian Buffer Criteria (>260 Woody & <320 Hardwood)
- No sample for 2012 due to beaver flooding

0 200 400 Feet

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Aerial Source: NCONEMAP
2010 Statewide Imagery

November 2012

APPENDIX B

Table 5 - Visual Stream Morphological Stability Assessment
Reach ID - Reach 2
Assessed Length – 2989 LF

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run Units)	1. Aggradation			1	350	88 %			
		2. Degradation			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate	42	44			95%			
	3. Meander Pool Condition	1. Depth	42	42			100%			
		2. Length	41	42			97%			
	4. Thalweg Condition	1. Thalweg at upstream of meander bend	NA	NA			NA			
		2. Thalweg centering at downstream of meander	NA	NA			NA			
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover from pour growth and/or scour and erosion			1	100	97%	NA	NA	98%
	2. Undercut	Banks undercut/overhanging			0	0	100%	NA	NA	98%
	3. Mass Wasting	Bank slumping, caving, or collapse			1	100	97%	NA	NA	98%
				Totals	2	200	93%	NA	NA	98%
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	17	19			89%			
	2. Grade Control	Grade Control exhibiting maintenance of grade across the ill	8	8			100%			
	2a. Piping	Structures Lacking any substantial flow underneath sills or arms	10	11			91%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%	10	11			91%			
	4. Habitat	Pool forming structures maintaining – Max Pool Depth: Mean Bankfull Depth Ratio $\geq$ 1.6 Rootwads/logs providing some cover at base flow.	40	42			95%			

Table 6 – Vegetation Condition Assessment
Planted Acreage - NA

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very Limited Cover of both woody and herbaceous material	No bare areas located onsite	NA	NA	NA	No bare areas located onsite
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria	No bare areas located onsite	RED	0	0	No bare areas located onsite
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year	No bare areas located onsite	RED	0	0	No bare areas located onsite

Appendix B – Stream Problem Areas Inventory Table

Stream Problem Areas East Tarboro Canal Stream Restoration Site EEP Project No. 123				
Feature Issue	**Reach**	**Station Number**	**Suspected Cause**	**Photo Number**
Bank Scour/Erosion	Reach 2	21+50	Rock vain failed	SP1
Beavers	Reach 2	Throughout – See figure 2	Beavers	SP2

B.4 Stream Photo Station Photos (all photos recorded on November 13, 2012)

Photo Station 5. Beginning of Reach 2 Downstream

Photo Station 6. Beginning of Reach 2 Downstream

Photo Station 7. Wilson Street Crossing Upstream

Photo Station 8. Wilson Street Crossing – Downstream

Photo Station 9. Culvert entry downstream

Photo Station 10. Pool Culvert Downstream

Photo Station 11. Reach 2 End of Project

Stream Problem Area Photos (all photos recorded on November 16, 2012)

SP1 – Marginal bank erosion near culvert - Station 10+00 – Reach 2

SP2 – Beaver Dam and ponding - Sta. 29+50 - Reach 2

Vegetation Plot Photos (Photos captured on October 16, 2012)

Vegetation Plot 2

Vegetation Plot 3

Vegetation Plot 4

Vegetation Plot 5

Vegetation Plot 6 – 2011 photo shown. 2012 photo was corrupt and will be updated at a later date.

Vegetation Plot 7 – Plot 7 is underwater due to beaver dam flooding and not accessible for pictures.

Vegetation Plot 8 – Plot 8 is underwater due to beaver dam flooding and not accessible for pictures.

Vegetation Plot 9

Vegetation Plot 10

Vegetation Plot 11

Vegetation Plot 12

Vegetation Plot 13

Appendix C - Vegetation Problem Areas Photos

VPA1 – Beaver dam ponding – Vegetation Plots 7 and 8 – Reach 2

VPA2 – Planted red maple (*Acer rubrum*) and tagged as yellow poplar (*Liriodendron tulipifera*)

(Photos Recorded on October 16, 2012)

APPENDIX C

Table 7. Vegetation Plot Criteria Attainment Stream Criteria			
Tract	**Vegetation Plot ID**	**Vegetation Survival Threshold Met?**	**Tract Mean**
Reach 1*	VP1*	Did not Monitor for 2012*	NA
Reach 2**	VP2	Y	92%
Reach 2**	VP3	Y	
Reach 2**	VP4	N	
Reach 2**	VP5	Y	
Reach 2**	VP6	Y	
Reach 2**	VP7	Did not Monitor for 2012***	
Reach 2**	VP8	Did not Monitor for 2012***	
Reach 2**	VP9	Y	
Reach 2**	VP10	Y	
Reach 2**	VP11	Y	
Reach 2**	VP12	Y	
Reach 2**	VP13	Y	

*Reach 1 and all Reach 1 assets have been removed from the East Tarboro Canal Stream Restoration Project
** The East Tarboro Canal Stream Restoration Project received supplemental planting in February 2011
*** Due to beaver pond dam ponding, this plot was not sampled for MY5 2012

Table 7a. Vegetation Plot Criteria Attainment Buffer Criteria			
Tract	**Vegetation Plot ID**	**Vegetation Survival Threshold Met?**	**Tract Mean**
Reach 1*	VP1*	Did not Monitor for 2012*	NA
Reach 2**	VP2	Y	75%
Reach 2**	VP3	Y	
Reach 2**	VP4	N	
Reach 2**	VP5	Y	
Reach 2**	VP6	Y	
Reach 2**	VP7	Did not Monitor for 2012***	
Reach 2**	VP8	Did not Monitor for 2012***	
Reach 2**	VP9	Y	
Reach 2**	VP10	Y	
Reach 2**	VP11	Y	
Reach 2**	VP12	N	
Reach 2**	VP13	N	

*Reach 1 and all Reach 1 assets have been removed from the East Tarboro Canal Stream Restoration Project
** The East Tarboro Canal Stream Restoration Project received supplemental planting in February 2011
*** Due to beaver pond dam ponding, this plot was not sampled for MY5 2012

Table 8. CVS Vegetation Plot Metadata
East Tarboro Canal EEP No: 123

Report Prepared By	William (Pete) Stafford
Date Prepared	11/28/2012 17:33
Database Name	EastTarboroCanal.mdb
Database Location	C:\Documents and Settings\pstafford\Desktop\CVS Veg Data
Computer Name	STAFFORDP
Description Worksheets In This Document	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
Project Summary	
Project Code	123
Project Name	East Tarboro Canal
Description	Stream Restoration Project
River Basin	Tar-Pamlico
Length(ft)	2989 LF
Stream-to-edge width (ft)	
Area (sq m)	
Required Plots (calculated)	

Table 9 - Planted and Total Counts (Species by Plot with Annual Means)

			CURRENT DATA (MY5 2012)																								ANNUAL MEANS							
			Plot 1**		Plot 2		Plot 3		Plot 4		Plot 5		Plot 6		Plot 7****		Plot 8****		Plot 9		Plot 10		Plot 11		Plot 12		Plot 13		Current Mean***		MY4 (2011)		MY3 (2010)		MY2 (2009)	
Scientific Name	Common Name	Type	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T
Alnus serrulata	Tag Alder	Shrub																	1	1									1	1	1	1	2	2	2	3
Betula nigra	**River Birch**	Tree			4	5			1	1			1	1					2	2	1	1		1	2	2	1	1	12	14	19	19	2	1	2	2
Cornus amomum	**Silky Dogwood**	Tree																			1	1		1			1	1	2	3	2	2	5	1	5	5
Cornus florida	**Dogwood**	Tree											1	1															1	1	2	2	1	2	1	1
Fraxinus pennsylvanica	**Green Ash**	Tree				3	3	3			2	2							1	1	6	6	3	3		1			15	19	24	24	3	10	3	3
Hamamelis	Witch Hazel	Shrub																											0	0	1	1	1	1	1	1
Itea virginica	Sweetspire	Shrub					1	1			2	2							1	1									4	4	3	3	5	3	5	12
Liriodendron tulipifera	**Poplar**	Tree									2	2																	2	2	7	7	N/A	N/A	N/A	N/A
Myrica sp.	Wax Myrtle	Shrub			1	1			1	1			1	1					1	1			2	2	2	2	4	4	12	12	12	12	21	13	21	1
Nyssa biflora	**Black Gum**	Tree																	2	2					1	1	1	1	4	4	4	4	10	6	10	13
Platanus occidentalis	**Sycamore**	Tree							3	3			1	1									7	8			4	4	15	16	20	20	N/A	N/A	N/A	N/A
Quercus laurifolia	**Laurel Oak**	Tree																											0	0	0	0	3	1	3	1
Quercus lyrata	**Overcup Oak**	Tree					1	1															1						2	1	3	3	1	3	1	4
Quercus pagoda	**Cherrybark Oak**	Tree			2	2	4	4			2	2							6	6						1			14	15	8	8	7	7	7	8
Quercus palustris	**Pin Oak**	Tree											1	1					1	1									2	2	1	1	2	2	2	1
Quercus phellos	**Willow Oak**	Tree			1	2					1	2	3	3					1	1	2	2	2	2	3	3			13	15	14	14	4	2	4	2
Rosa palustris	Swamp Rose	Shrub					1	3													1	2	1	2					3	7	5	5	7	6	7	4
Salix caroliniana	**Willow**	Tree						2		3	4	5														1			4	11	4	4	4	4	4	4
Taxodium distichum	**Bald Cypress**	Tree			1	1																							1	1	2	2	1	1	1	1
Unknown											1	1															1	2	2	3	3	3	47	6	47	14
Cephalanthus occ.	Buttonbush	Shrub				2																							0	1	4	4		4		
Baccharis halimifolia	Silverling	Shrub				1						2								1				1				1	0	6						
Liquidambar styr.	Sweet gum	Tree								1										20		5		5				6	0	37						
Acer rubrum	Red maple	Tree																	1	1									1	1						
Acer negundo	Box elder	Tree				1														1								1	0	3						
Pinus taeda	Lob. Pine	Tree												1						4		1						5	0	11						
Pyrus calleryana	Bradford pear	Tree												1						1		1							0	1						
Ligustrum sinense	Chinese privet	Shrub																				1							0	1						
Celtis sp.	Sugarberry	Shrub																									2	2	2	2						
Sambucus can.	Elderberry	Shrub																										1	0	1						
Viburnumsp.	Viburnum	Shrub				1			1	1			2	2									1	1					0	1						
		Plot Area (acres)	0.025		0.025		0.025		0.025		0.025		0.025		0.025		0.025		0.025		0.025		0.025		0.025		0.025									
		Species Count		0	5	10	5	6	4	6	7	8	7	9					10	15	5	9	7	10	4	7	7	12	21	31	20	10	18	19	18	18
		Stem Count		0	9	19	10	14	6	10	14	18	10	12					17	44	11	20	17	26	8	11	14	29	112	196	139	139	113	75	113	80
Stream Restoration Criteria		Stems/Acre		0	360	760	400	560	240	400	560	720	400	480					680	1760	440	800	680	1040	320	440	560	1160	464	812	463	463	363	250	363	320
		Species Count		0	4	5	3	4	2	3	5	5	5	5					5	5	4	4	4	5	4	5	4	4	13	7	13	13	12	12	12	10
		Stem Count		0	8	13	8	10	4	7	11	13	7	7					13	13	10	10	13	15	6	9	7	7	87	104	110	110	33	40	33	39
Buffer Restoration Criteria		Stems/Acre		0	320	520	320	400	160	280	440	520	280	280					520	520	400	400	520	600	240	360	280	280	348	416	367	367	110	133	110	172

*Bolded tree species are counted toward riparian buffer success criteria

**Reach 1 and all Reach 1 assets have been removed from the East Tarboro Canal Stream Restoration Project

***East Tarboro Canal was replanted in February 2011, the 2011 MY4 (Current Mean) data will be used as baseline to account for the new planted stems

****Due to beaver dam flooding, Plot 7 and Plot 8 were not counted. These plots were not used in stems/acre calculations.

APPENDIX D

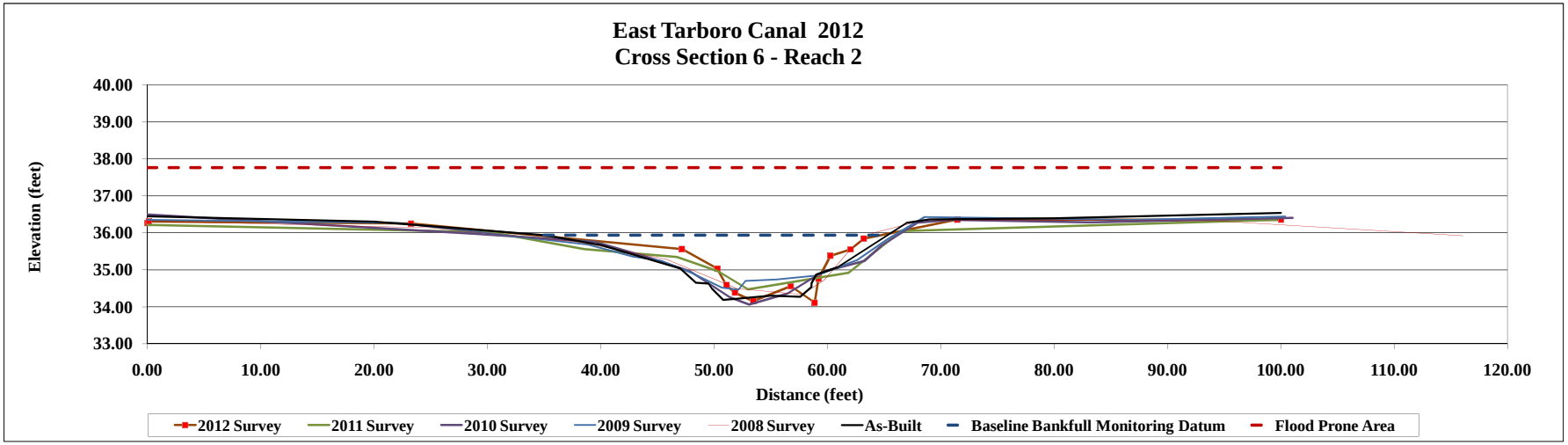
Project Name East Tarboro Canal
Watershed Tar River MY5
Cross Section 6
Drainage Area NA
Date Nov-12
Crew Tutt, Singletary

Photo of Cross-Section #6 - Looking Downstream

Picture Taken November 14, 2012

As-Built Survey			2008			2009			2010			2011			2012		
As-Built Survey			2008 Survey			2009 Survey			2010 Survey			2011 Survey			2012 Survey		
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes
0.00	36.45	LPIN	0.00	36.32		0.00	36.35		0.00	36.50		0.00	36.22		0.00	36.26	
20.00	36.30		25.08	36.14		22.07	36.27		29.01	35.97		30.36	36.02		0.12	36.30	
35.00	35.94	BKF	38.26	35.74		38.88	35.68		39.47	35.76		38.52	35.56		23.27	36.25	
40.00	35.67		45.82	35.29		42.86	35.35		44.32	35.32		46.71	35.35		47.16	35.56	
47.00	35.04		52.03	34.49		45.30	35.25		47.88	34.96		50.35	34.96		50.28	35.03	
48.40	34.65		57.78	34.33		48.03	34.92		51.39	34.26		52.99	34.47		51.09	34.59	
49.50	34.63	LEW	59.72	34.73		50.69	34.52		52.41	34.14		61.88	34.92		51.83	34.38	
49.80	34.49		62.08	35.58		52.16	34.46		53.08	34.07		66.53	36.05		53.45	34.16	
50.80	34.19	TW	63.97	35.99		52.77	34.70		56.47	34.36		99.63	36.35		56.77	34.56	
52.00	34.22		68.53	36.35		55.50	34.74		59.56	34.95					58.88	34.12	
55.00	34.30		94.15	36.33		59.02	34.84		63.27	35.25					59.19	34.76	
57.60	34.27		116.05	35.92		62.67	35.27		64.78	35.66					60.27	35.38	
58.60	34.54					65.29	35.83		67.95	36.28					62.05	35.55	
58.60	34.64	REW				68.58	36.43		70.94	36.35					63.22	35.85	
59.00	34.87					86.79	36.35		83.20	36.28					71.44	36.36	
60.90	35.07					100.38	36.44		101.03	36.40					100.02	36.35	
67.00	36.27																
69.00	36.36																
80.00	36.39																
100.00	36.54	RPIN															

Summary Data	
Bankfull Elv.	35.94
BF Area	20.4
BF Width	30.7
Flood Prone Elv.	37.76
Flood Prone Width	100
Max Depth	1.8
Mean Depth	0.7
W/D Ratio	46
ER	3.3
Bank Height Ratio	
Stream Type	C5



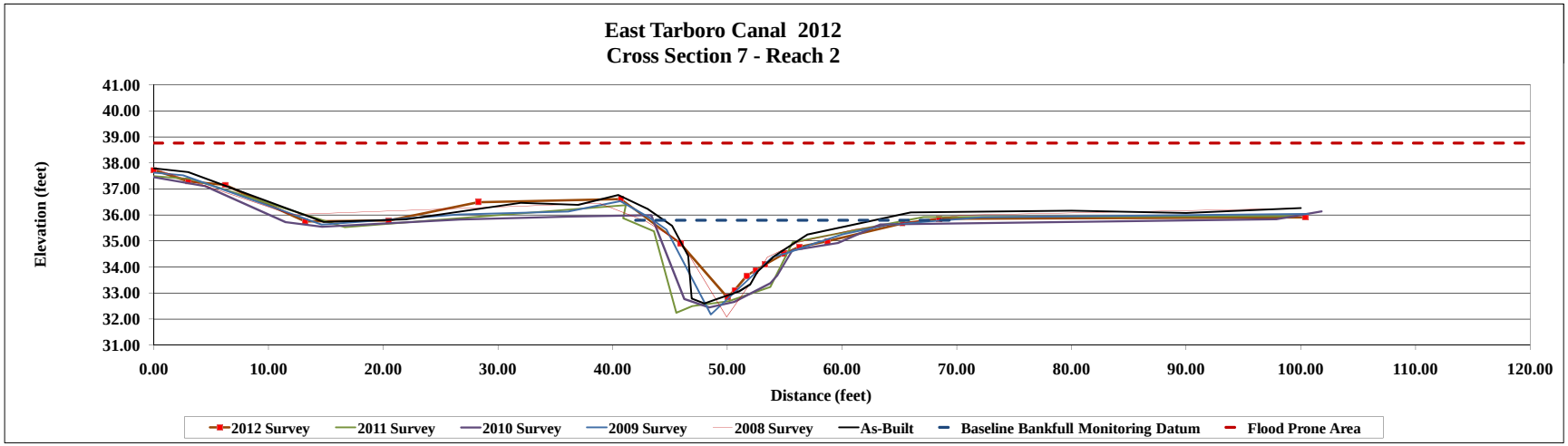
Project Name	East Tarboro Canal
Watershed	Tar River MY5
Cross Section	7
Drainage Area	NA
Date	Nov-12
Crew	Tutt, Singletary

Photo of Cross-Section #7 - Looking Upstream

Picture Taken November 14, 2012

As-Built Survey As-Built Survey			2008 2008 Survey			2009 2009 Survey			2010 2010 Survey			2011 2011 Survey			2012 2012 Survey		
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes
0.00	37.79	LPIN	0.00	37.79		0.00	37.63		0.00	37.45		0.00	37.49		0.00	37.73	
3.00	37.65		12.00	36.02		2.53	37.53		4.47	37.11		3.26	37.38		3.00	37.29	
14.80	35.73		38.87	36.45		14.64	35.63		11.49	35.72		16.65	35.52		6.19	37.16	
22.00	35.83		42.91	35.76		26.68	36.02		14.66	35.54		41.16	36.38		13.21	35.76	
32.00	36.46		46.03	34.92		36.11	36.13		26.67	35.83		40.91	35.87		20.46	35.78	
37.00	36.39		49.94	32.08		40.69	36.53		36.11	35.94		43.60	35.38		28.28	36.49	
40.50	36.77		52.84	33.91		43.26	35.89		43.36	35.99		45.56	32.24		40.72	36.61	
43.00	36.24		53.48	34.38		44.70	35.44		46.24	32.77		46.93	32.50		45.89	34.92	
45.20	35.57		56.17	34.94		48.57	32.17		48.41	32.45		50.13	32.69		50.01	32.84	
46.60	34.43	LEW	61.09	35.45		53.95	34.40		50.59	32.66		53.74	33.24		50.64	33.11	
46.90	32.79		70.47	35.99		55.15	34.52		53.74	33.37		55.69	34.95		51.69	33.66	
48.00	32.60	TW	100.00	36.26		57.45	34.88		54.40	33.69		67.11	35.92		52.46	33.87	
49.00	32.75					60.11	35.27		55.69	34.64		99.33	35.95		53.28	34.09	
51.00	33.06					64.10	35.63		59.63	34.92					54.93	34.51	
52.00	33.33					72.13	35.90		63.34	35.63					56.29	34.77	
52.60	33.81					100.66	36.04		97.87	35.84					58.72	34.99	
54.10	34.41	REW							101.81	36.13					65.26	35.67	
57.00	35.25														68.46	35.86	
66.00	36.10	BKF													100.37	35.91	
80.00	36.17																
90.00	36.07																
100.00	36.26	RPIN															

Summary Data	
Bankfull Elv.	35.8
BF Area	26.2
BF Width	31.9
Flood Prone Elv.	38.76
Flood Prone Width	100.4
Max Depth	3
Mean Depth	0.8
W/D Ratio	39
ER	3.1
Bank Height Ratio	
Stream Type	C5



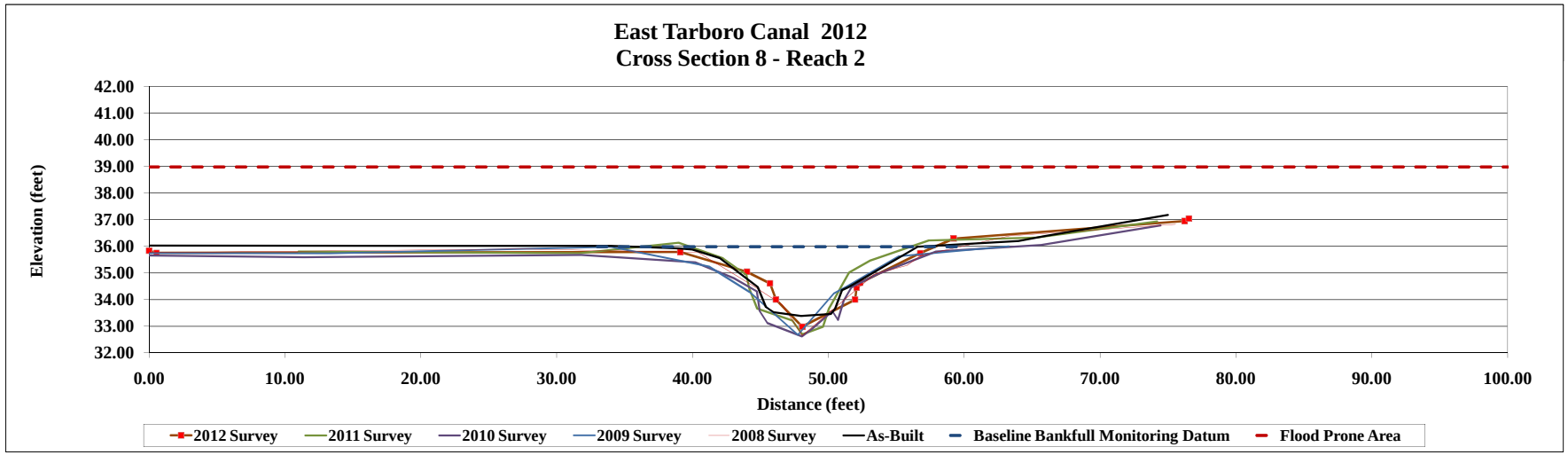
Project Name East Tarboro Canal
Watershed Mill Creek, MY4
Cross Section 8
Drainage Area NA
Date Mar-11
Crew Tutt, Stafford

Photo of Cross-Section #8 - Looking Upstream

Picture Taken November 14, 2012

As-Built Survey			2008			2009			2010			2011			2012		
As-Built Survey			2008 Survey			2009 Survey			2010 Survey			2011 Survey			2012 Survey		
12.00	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes
0.00	36.03	LPIN	0.00	35.76		0.00	35.74		0.00	35.65		0	35.7		0.00	35.83	
20.00	36.02		27.39	35.90		13.34	35.73		11.42	35.59		11.01	35.81		0.55	35.75	
34.00	36.02		40.41	35.77		34.02	35.98		31.83	35.68		31.70	35.74		39.10	35.79	
39.00	35.92		44.41	34.53		41.21	35.24		40.20	35.40		38.97	36.13		44.01	35.04	
40.00	35.88		46.63	33.80		44.22	34.27		43.06	34.80		42.25	35.55		45.71	34.61	
42.00	35.56		48.09	32.65		47.75	32.68		44.75	34.30		43.97	34.93		46.14	34.00	
44.80	34.47	LEW	52.77	34.69		50.42	34.23		44.95	33.56		44.18	34.42		48.08	32.98	
45.40	33.71		53.36	34.95		51.31	34.48		45.52	33.12		44.76	33.67		51.98	34.00	
46.00	33.52		55.78	35.28		55.22	35.63		48.07	32.62		47.35	33.21		52.08	34.45	
48.00	33.38	TW	56.84	35.66		63.30	36.00		48.79	32.90		48.08	32.69		52.33	34.63	
50.20	33.46		63.32	36.38		74.01	36.86		50.29	33.56		49.61	32.98		56.76	35.74	
50.50	33.66		75.55	36.82					50.71	33.23		50.04	33.66		59.24	36.29	
51.00	34.35								51.14	33.95		50.47	34.06		76.23	36.95	
51.50	34.47	REW							51.71	34.46		51.05	34.58		76.53	37.04	
56.60	35.98	BKF							52.18	34.58		51.53	35.01				
64.00	36.20								53.70	34.97		53.08	35.46				
66.00	36.39								57.93	35.80		57.38	36.22				
75.00	37.18	RPIN							65.67	36.05		65.26	36.32				
									74.45	36.78		74.20	36.93				

Summary Data	
Bankfull Elv.	35.98
BF Area	32.4
BF Width	57.8
Flood Prone Elv.	38.98
Flood Prone Width	76.5
Max Depth	3
Mean Depth	0.6
W/D Ratio	103.3
ER	1.3
Bank Height Ratio	
Stream Type	C5



Project Name	East Tarboro Canal
Watershed	Mill Creek, MY4
Cross Section	9
Drainage Area	NA
Date	Mar-11
Crew	Tutt, Stafford

Photo of Cross-Section #10 - Unable to stretch tape across stream due to beaver flooding

Picture Taken November 14, 2012

As-Built Survey
As-Built Survey

Station	Elv	Notes
0.00	34.41	LPIN
20.00	34.44	
37.00	34.39	
42.00	34.61	
45.00	35.08	
47.00	34.51	
48.20	34.00	
49.20	32.08	LEW
51.00	31.03	TW
51.80	31.10	
53.10	31.71	
54.50	31.73	
55.00	32.08	REW
58.00	32.74	
63.00	34.00	
67.00	34.24	BKF
80.00	34.07	
90.00	34.10	
100.00	34.25	
101.40	34.25	RPIN

2008
2008 Survey

Station	Elv	Notes
0.00	34.40	
31.81	34.84	
38.72	34.32	
39.90	33.24	
54.34	30.37	
57.17	32.15	
58.59	33.23	
60.90	33.91	
65.70	34.41	
76.79	34.12	
99.09	34.35	

2009
2009 Survey

Station	Elv	Notes
0.00	34.22	
10.00	34.22	
34.76	34.19	
50.10	30.60	
54.90	32.61	
55.85	32.99	
58.96	33.90	
65.41	34.26	
77.54	34.01	
97.90	34.21	

2010
2010 Survey

Station	Elv	Notes
0.00	34.37	
36.60	34.72	
38.71	34.04	
42.51	30.83	
44.18	29.53	
51.94	30.94	
54.41	33.40	
56.98	33.59	
59.22	34.40	
76.82	34.16	
90.46	34.32	
98.99	34.49	

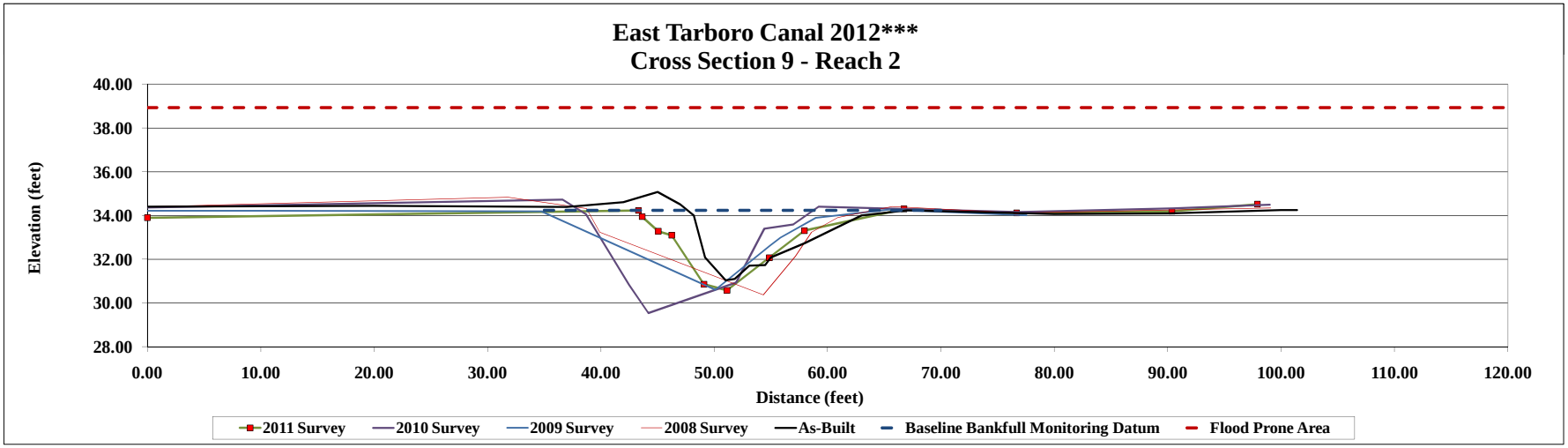
2011
2011 Survey

Station	Elv	Notes
0.00	33.90	
43.31	34.23	
43.64	33.95	
45.08	33.28	
46.24	33.10	
49.09	30.86	
51.13	30.58	
54.86	32.07	
57.96	33.31	
66.74	34.30	
76.67	34.12	
90.36	34.19	
97.92	34.52	

2012
2012 Survey

Station	Elv	Notes

Summary Data	
Bankfull Elv.	34.24
BF Area	44.5
BF Width	20.02
Flood Prone Elv.	37.9
Flood Prone Width	97.9
Max Depth	3.7
Mean Depth	2.2
W/D Ratio	9
ER	4.9
Bank Height Ratio	
Stream Type	C5



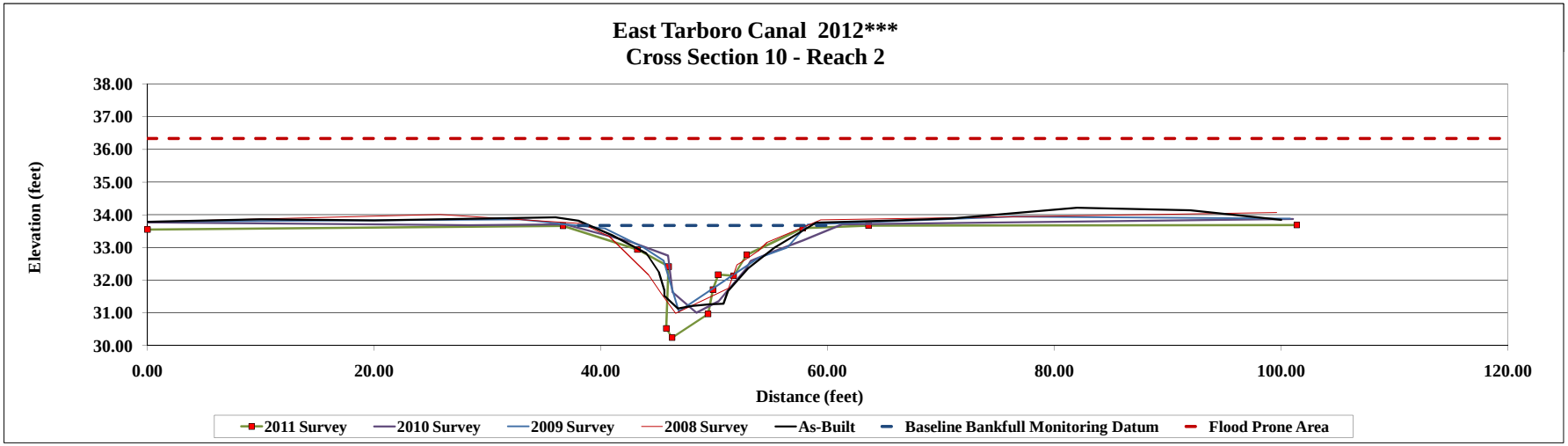
Project Name	East Tarboro Canal
Watershed	Mill Creek, MY4
Cross Section	10
Drainage Area	NA
Date	Mar-11
Crew	Tutt, Stafford

Photo of Cross-Section #10 - Unable to stretch tape across stream due to beaver flooding

Picture Taken November 14, 2012

As-Built Survey			2008			2009			2010			2011			2012		
As-Built Survey			2008 Survey			2009 Survey			2010 Survey			2011 Survey			2012 Survey		
Station	Elv	Notes	Station	Elv	Notes	Station	Elv	Notes	Station	Elv	Notes	Station	Elv	Notes	Station	Elv	Notes
0.00	33.78	LPIN	0.00	33.78		0.00	33.79		0.00	33.76		0.00	33.55				
10.00	33.86		25.81	34.00		32.90	33.86		28.37	33.68		36.66	33.66				
20.00	33.83		38.28	33.73		40.35	33.58		36.85	33.71		43.22	32.94				
36.00	33.92		40.74	33.33		43.73	33.01		42.70	33.17		45.97	32.41				
38.00	33.82		44.20	32.16		45.54	32.59		45.92	32.75		45.77	30.53				
41.00	33.37		45.45	31.53		46.89	31.04		46.32	31.64		46.28	30.24				
44.00	32.82		46.60	30.99		53.95	32.69		48.42	31.00		49.45	30.97				
45.10	32.25		51.25	31.75		56.42	33.00		50.40	31.36		49.88	31.71				
45.60	31.68	LEW	51.99	32.46		58.23	33.70		52.83	32.36		50.34	32.17				
45.60	31.52		52.72	32.62		76.34	33.94		53.21	32.58		51.71	32.13				
46.80	31.13	TW	53.86	32.89		100.78	33.88		55.07	32.85		52.86	32.77				
48.00	31.21		54.66	33.16					57.84	33.22		57.80	33.59				
49.60	31.26		59.39	33.85					61.29	33.71		63.61	33.67				
50.80	31.28		99.61	34.07					101.06	33.87		101.39	33.69				
51.20	31.67	REW															
53.00	32.36																
55.30	32.99																
59.00	33.76	BKF															
66.00	33.83																
71.00	33.89																
82.00	34.21																
92.00	34.14																
100.00	33.84	RPIN															

Summary Data	
Bankfull Elv.	33.67
BF Area	26.5
BF Width	63.5
Flood Prone Elv.	37
Flood Prone Width	103.4
Max Depth	3.4
Mean Depth	0.4
W/D Ratio	152.2
ER	1.6
Bank Height Ratio	
Stream Type	C5



Project Name	East Tarboro Canal
Watershed	Tar River MY5
Cross Section	11
Drainage Area	NA
Date	Nov-12
Crew	Tutt, Singletary

Photo of Cross-Section #11 - Looking Downstream - Beaver Dam located on cross section

Picture Taken November 14, 2012

As-Built Survey

Station	Elv	Notes
0.00	34.73	LPIN
7.00	33.02	
20.00	33.19	
37.00	33.06	BKF
45.00	31.42	
47.40	31.13	LEOW
50.00	30.77	
51.00	30.58	
52.00	30.38	TW
53.80	30.67	
53.80	31.15	REOW
54.10	32.53	
56.00	33.08	
62.00	33.56	
70.00	33.59	
90.00	33.27	
96.00	33.24	
100.00	33.83	RPIN

2008 Survey

Station	Elv	Notes
100.86	33.99	
95.21	33.37	
62.08	33.82	
55.44	33.17	
53.68	32.85	
52.99	32.31	
51.53	32.06	
49.29	30.12	
45.72	31.37	
43.52	32.00	
38.01	33.01	
26.25	33.39	
4.14	33.41	
0.00	34.63	

2009 Survey

Station	Elv	Notes
0.00	34.72	
0.31	34.83	
6.82	33.21	
17.23	33.22	
34.84	33.11	
40.96	32.63	
43.29	32.37	
45.86	32.19	
51.42	30.16	
55.18	32.64	
55.96	32.75	
57.21	33.24	
58.84	33.44	
63.32	33.62	
80.80	33.48	
96.16	33.27	
101.71	33.94	

2010 Survey

Station	Elv	Notes
0.00	34.87	
6.10	33.21	
19.99	33.03	
24.28	32.79	
24.95	32.73	
27.45	32.71	
33.86	32.75	
44.26	32.05	
45.49	31.41	
47.23	30.75	
49.99	30.33	
53.30	31.60	
54.22	32.19	
55.89	32.54	
57.58	33.13	
58.12	33.14	
60.18	33.64	
65.60	33.67	
78.69	33.55	
97.81	33.26	
101.71	33.85	

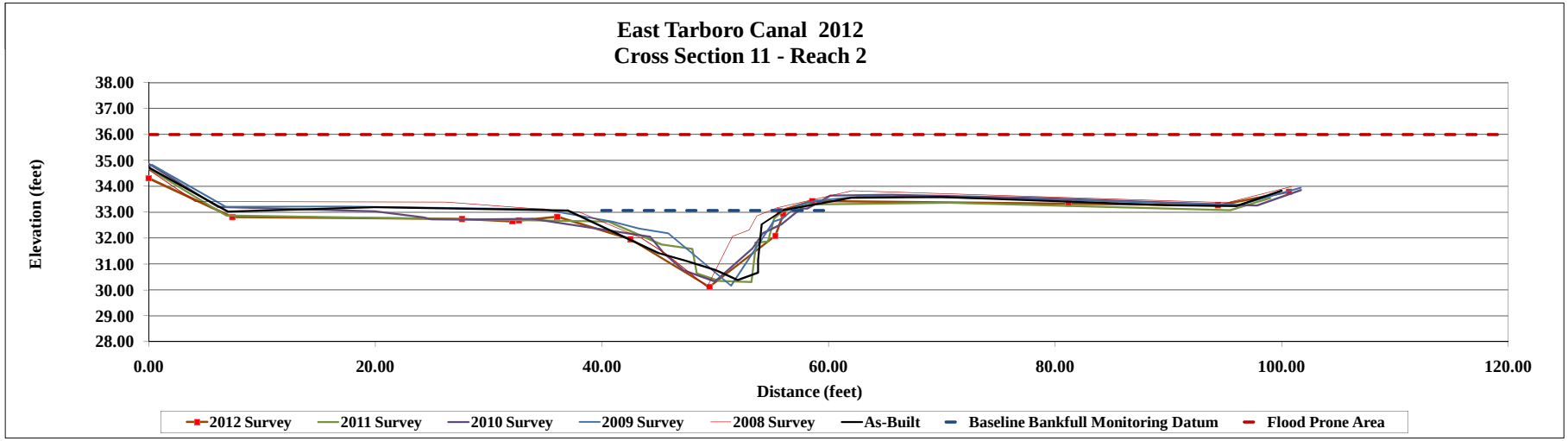
2011 Survey

Station	Elv	Notes
0.00	34.67	
6.82	32.87	
40.59	32.64	
45.27	31.75	
47.99	31.59	
48.37	30.63	
50.35	30.34	
53.20	30.31	
53.63	31.82	
53.54	31.82	
54.67	31.87	
55.20	32.75	
55.91	33.02	
58.35	33.29	
70.68	33.36	
95.47	33.07	
99.01	33.55	

2012 Survey

Station	Elv	Notes
0.00	34.31	
7.37	32.81	
27.65	32.74	
32.12	32.65	
32.68	32.68	
36.09	32.83	
42.53	31.96	
49.50	30.12	
55.32	32.09	
56.01	32.93	
55.68	33.05	
58.56	33.43	
81.19	33.33	
94.36	33.26	
100.65	33.79	

Summary Data	
Bankfull Elv.	33.06
BF Area	38.9
BF Width	49.6
Flood Prone Elv.	36
Flood Prone Width	100.7
Max Depth	2.9
Mean Depth	0.8
W/D Ratio	63.2
ER	2
Bank Height Ratio	
Stream Type	C5



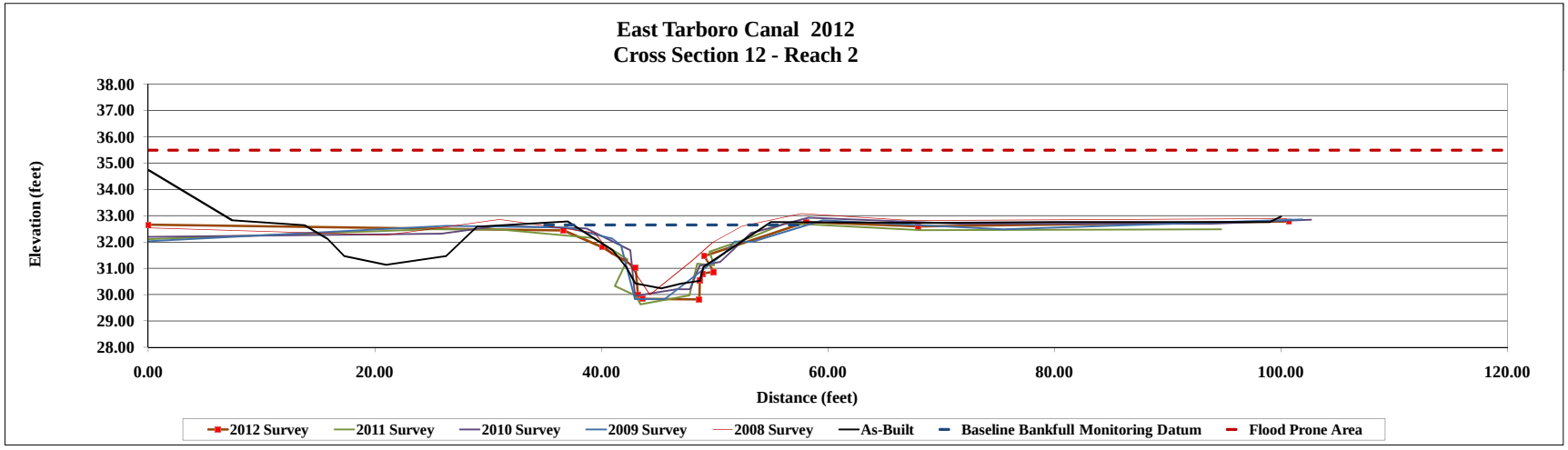
Project Name	East Tarboro Canal
Watershed	Tar River MY5
Cross Section	12
Drainage Area	NA
Date	Nov-12
Crew	Tutt, Singletary

Photo of Cross-Section #12 - Looking Downstream

Picture Taken November 14, 2012

As-Built Survey			2008			2009			2010			2011			2012		
As-Built Survey			2008 Survey			2009 Survey			2010 Survey			2011 Survey			2012 Survey		
Station	Elv	Notes	Station	Elv	Notes	Station	Elv	Notes	Station	Elv	Notes	Station	Elv	Notes	Station	Elv	Notes
0.00	34.74	LPIN	0.00	32.54		0.00	32.02		0.00	32.20		0.00	32.11		0.00	32.66	
7.40	32.83		21.01	32.26		26.33	32.62		25.88	32.31		25.00	32.49		36.66	32.44	
13.80	32.64		31.01	32.86		36.95	32.55		30.97	32.62		31.15	32.47		40.06	31.81	
15.80	32.13		39.38	32.34		40.97	32.13		38.66	32.52		39.31	32.15		43.01	31.03	
17.30	31.47		40.89	31.55		41.73	31.88		42.56	31.68		42.30	31.34		43.23	30.00	
21.00	31.13		42.18	31.32		42.96	29.83		42.96	29.95		41.19	30.33		43.65	29.84	
26.30	31.47		42.76	30.97		45.59	29.83		46.67	30.20		43.05	29.96		48.63	29.81	
29.00	32.58		44.28	30.00		50.82	31.56		47.83	30.20		43.46	29.62		48.70	30.55	
37.00	32.78		48.01	31.29		51.74	32.02		48.68	31.10		47.76	29.97		48.95	30.80	
41.00	31.67		49.82	31.98		53.33	32.00		50.49	31.25		48.45	31.18		49.92	30.86	
42.20	31.04	LEW	52.41	32.61		59.54	32.82		53.19	32.33		49.95	31.11		49.08	31.47	
43.00	30.42		57.65	33.07		75.48	32.48		58.27	32.93		49.54	31.63		58.11	32.75	
45.30	30.24	TW	67.42	32.81		101.87	32.86		71.75	32.69		53.04	32.15		67.98	32.59	
47.00	30.41		100.49	32.90					93.85	32.69		56.24	32.72		100.70	32.78	
48.70	30.53								102.65	32.85		68.28	32.45				
49.00	31.04	REW										94.72	32.48				
55.00	32.76	BKF															
69.00	32.72																
80.00	32.76																
99.00	32.76																
100.00	32.97	RPIN															

Summary Data	
Bankfull Elv.	32.65
BF Area	31.3
BF Width	69.8
Flood Prone Elv.	35.49
Flood Prone Width	100.7
Max Depth	2.8
Mean Depth	0.4
W/D Ratio	155.6
ER	1.4
Bank Height Ratio	
Stream Type	C5



Project Name	East Tarboro Canal
Watershed	Tar River MY5
Cross Section	13
Drainage Area	NA
Date	Nov-12
Crew	Tutt, Singletary

Photo of Cross-Section #13 - Looking Upstream

Picture Taken November 14, 2012

As-Built Survey

Station	Elv	Notes
0	32.41	LPIN
5	32.16	
26	32.04	
40	31.92	BKF
49	31.14	
51.4	30.34	LEW
52.7	29.68	
55	29.54	
57.8	28.96	TW
58.6	29.22	
59.1	30.36	REW
60	30.95	
61.3	31.89	
69	32.92	
80	32.32	
92.4	32.32	
100	34.44	RPIN

2008 Survey

Station	Elv	Notes
0.00	32.50	
27.52	32.15	
41.46	32.04	
45.78	31.55	
47.33	31.09	
49.27	30.34	
52.64	30.73	
55.19	29.67	
57.49	29.30	
58.70	30.30	
59.76	31.12	
61.62	31.24	
62.70	31.84	
68.18	32.82	
92.94	32.27	
108.00	35.50	

2009 Survey

Station	Elv	Notes
0.00	32.02	
32.66	32.03	
46.73	31.47	
48.77	31.15	
55.98	29.21	
59.84	30.70	
61.89	30.92	
63.12	31.35	
69.6	32.89	
93.82	32.12	
105.18	35.08	

2010 Survey

Station	Elv	Notes
0	32.1491	
45.2	31.8066	
47.9	31.2745	
49.74	30.8204	
53.8	30.3593	
55	29.9394	
57.45	29.6481	
58.9	29.4379	
59.7	29.9288	
60.2	30.0276	
61.2	31.0628	
63.0	31.5896	
68.7	32.8511	
81.0	32.3745	
93.7	32.4328	
105.8	35.6026	

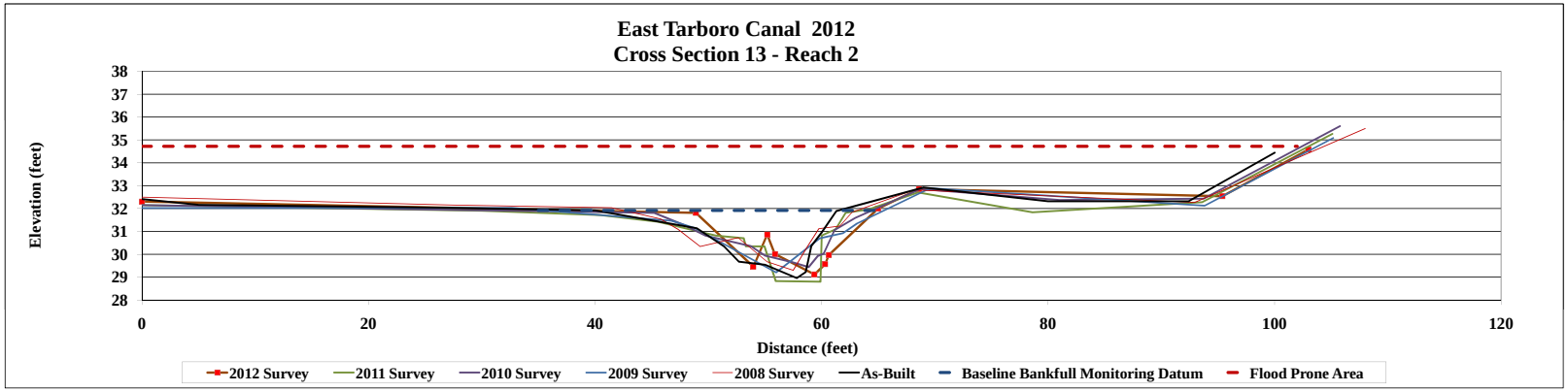
2011 Survey

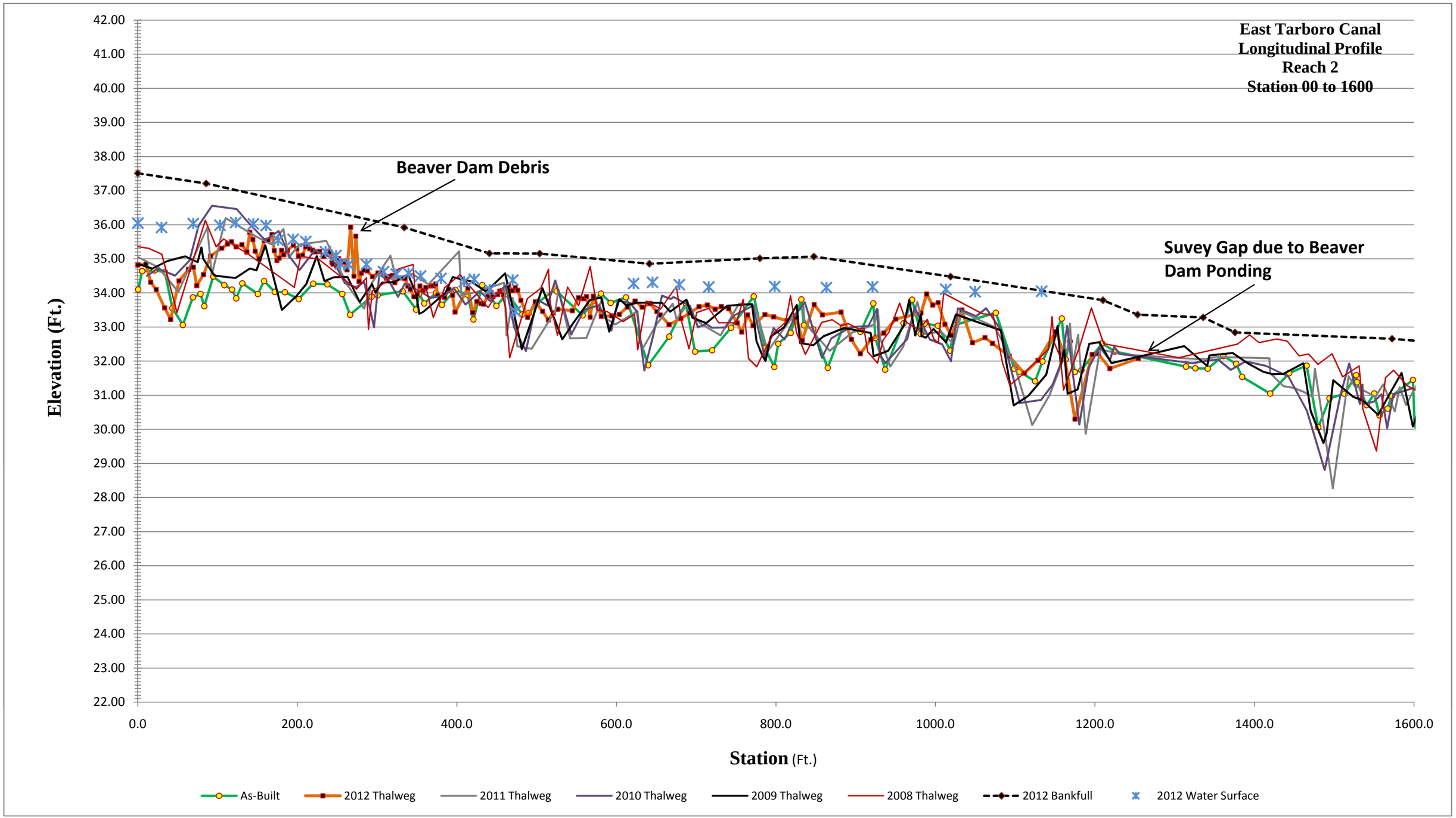
Station	Elv	Notes
0	32.15	
30	31.9	
40.5	31.72	
45.58	31.42	
50.65	30.82	
53.1	30.7	
53.31	30.35	
54.96	30.34	
56.0	28.83	
56.9	28.8	
59.9	28.8	
60.0	30.8	
61.2	31.1	
62.1	31.8	
64.2	32.0	
68.5	32.7	
78.6	31.8	
93.6	32.3	
105.1	35.3	

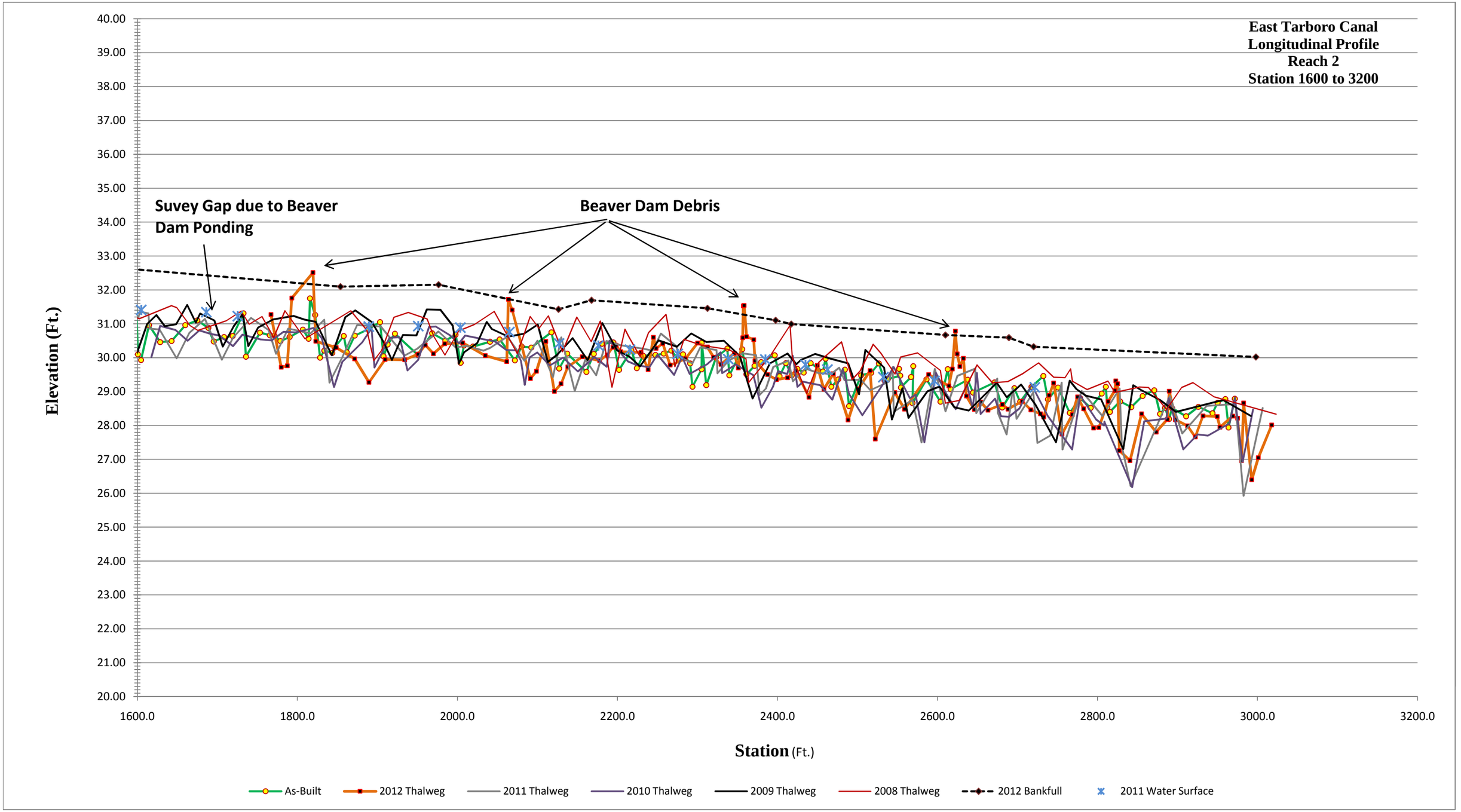
2012 Survey

Station	Elv	Notes
0	32.31	
48.91	31.81	
53.98	29.46	
55.2	30.87	
55.88	30.01	
59.37	29.12	
60.31	29.57	
60.65	29.97	
64.97	32	
68.59	32.85	
95.39	32.54	
103	34.58	

Summary Data	
Bankfull Elv.	31.92
BF Area	25.7
BF Width	26.7
Flood Prone Elv.	34.72
Flood Prone Width	72
Max Depth	2.8
Mean Depth	1
W/D Ratio	27.8
ER	2.7
Bank Height Ratio	
Stream Type	C5

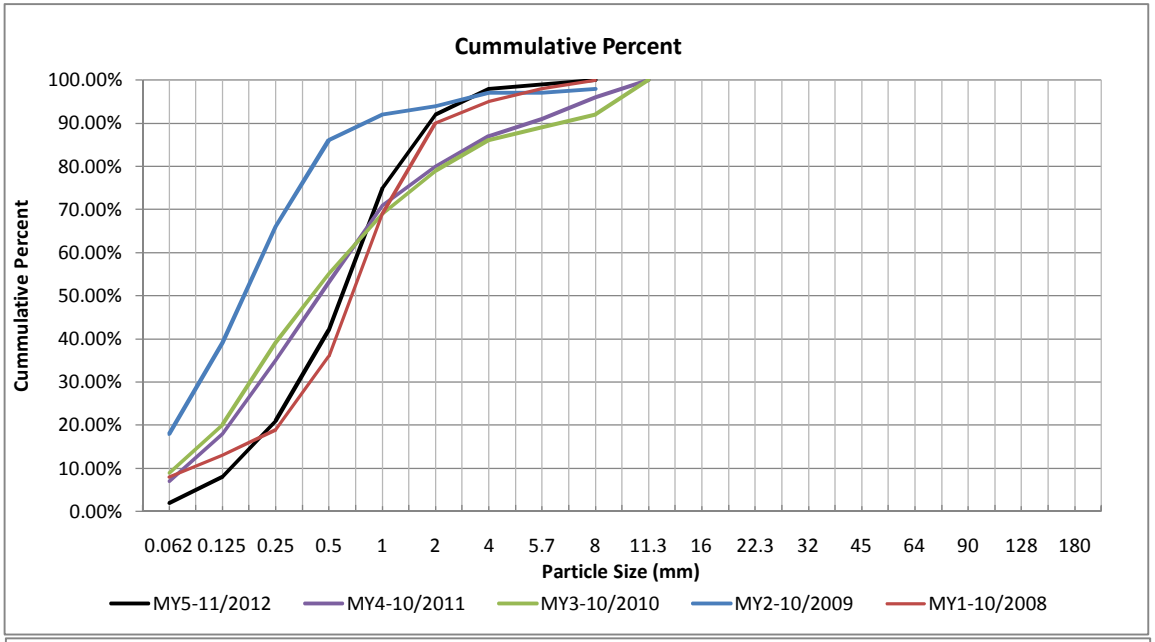


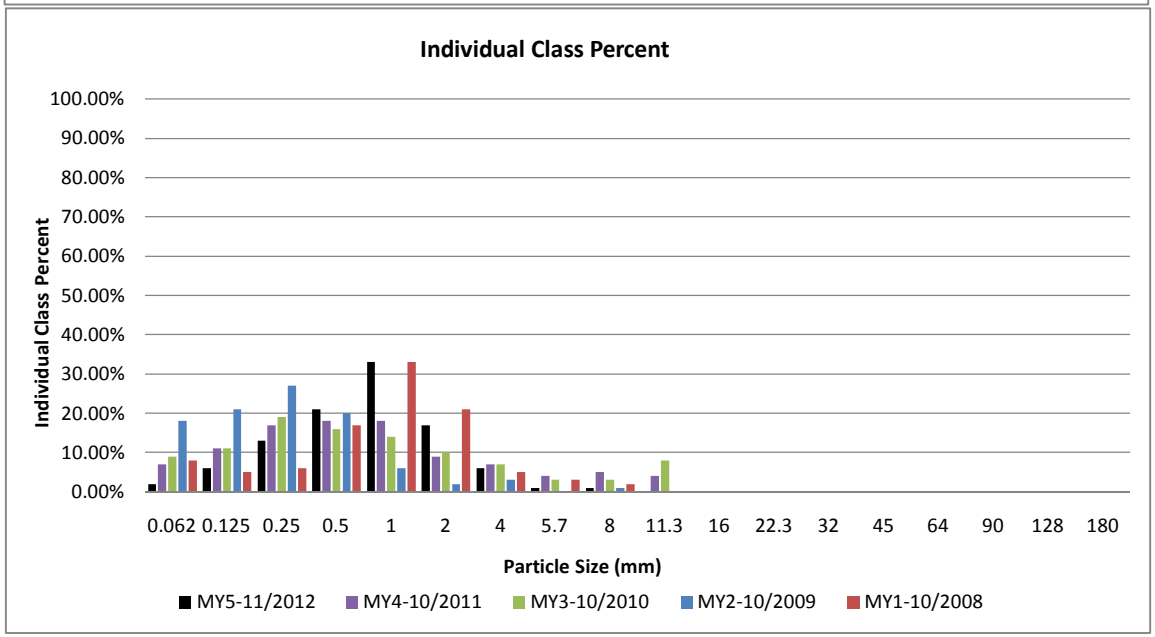

East Tarboro Canal
Longitudinal Profile
Reach 2
Station 00 to 1600
Beaver Dam Debris
Suvey Gap due to Beaver Dam Ponding
Elevation (Ft.)
42.00
41.00
40.00
39.00
38.00
37.00
36.00
35.00
34.00
33.00
32.00
31.00
30.00
29.00
28.00
27.00
26.00
25.00
24.00
23.00
22.00
0.0
200.0
400.0
600.0
800.0
1000.0
1200.0
1400.0
1600.0
Station (Ft.)
As-Built
2012 Thalweg
2011 Thalweg
2010 Thalweg
2009 Thalweg
2008 Thalweg
2012 Bankfull
2012 Water Surface


East Tarboro Canal
Longitudinal Profile
Reach 2
Station 1600 to 3200
Suvey Gap due to Beaver Dam Ponding
Beaver Dam Debris
Elevation (Ft.)
40.00
39.00
38.00
37.00
36.00
35.00
34.00
33.00
32.00
31.00
30.00
29.00
28.00
27.00
26.00
25.00
24.00
23.00
22.00
21.00
20.00
1600.0
1800.0
2000.0
2200.0
2400.0
2600.0
2800.0
3000.0
3200.0
Station (Ft.)
As-Built
2012 Thalweg
2011 Thalweg
2010 Thalweg
2009 Thalweg
2008 Thalweg
2012 Bankfull
2011 Water Surface

Project Name: East Tarboro Canal Cross Section: 6 Monitoring Year 5 - 2012					
Desc.	**Material**	**Size (MM)**	**Count**	**% of Total**	**Cumulative %**
SAND	silt/clay	0.062	2	2.00%	2.00%
	very fine sand	0.125	6	6.00%	8.00%
	fine sand	0.25	13	13.00%	21.00%
	medium sand	0.5	21	21.00%	42.00%
	coarse sand	1	33	33.00%	75.00%
	very coarse sand	2	17	17.00%	92.00%
GRAVEL	very fine gravel	4	6	6.00%	98.00%
	fine gravel	5.7	1	1.00%	99.00%
	fine gravel	8	1	1.00%	100.00%
	medium gravel	11.3			
	medium gravel	16			
	coarse gravel	22.3			
	coarse gravel	32			
	very coarse gravel	45			
	very coarse gravel	64			
COBBLE	small cobble	90			
	medium cobble	128			
	large cobble	180			
	very large cobble	256			
BOULDER	small boulder	362			
	small boulder	512			
	medium boulder	1024			
	large boulder	2048			
TOTAL % of whole count:			**100**	**100%**	**100%**

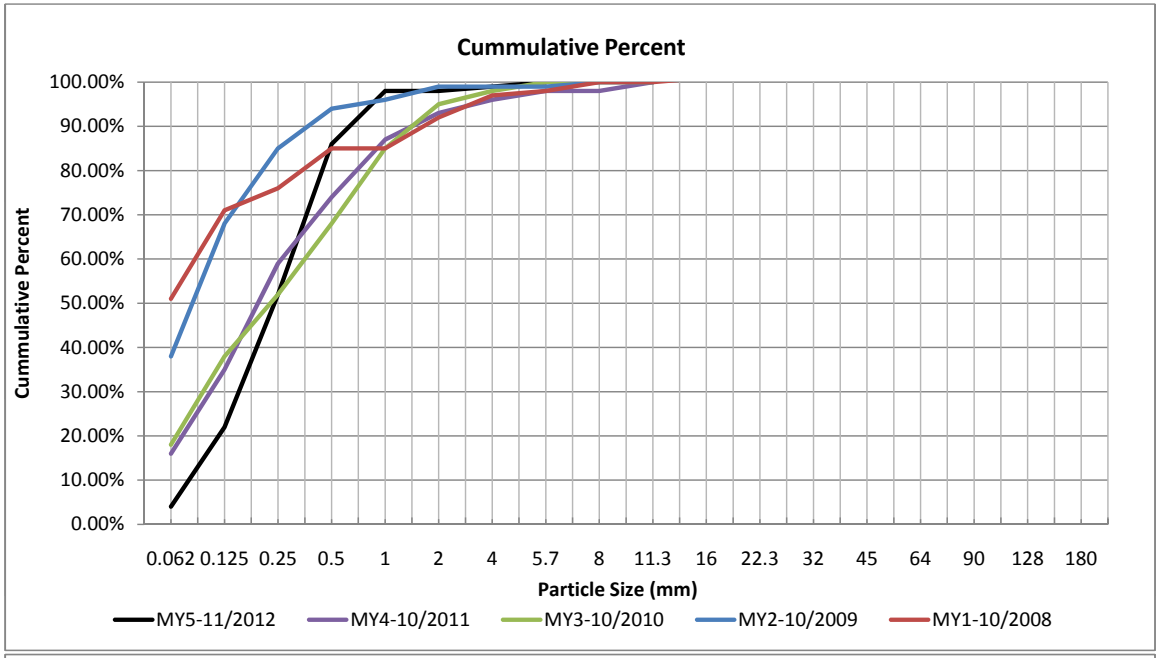
Sumamry Data	
D50	0.59
D84	1.4
D95	2.8

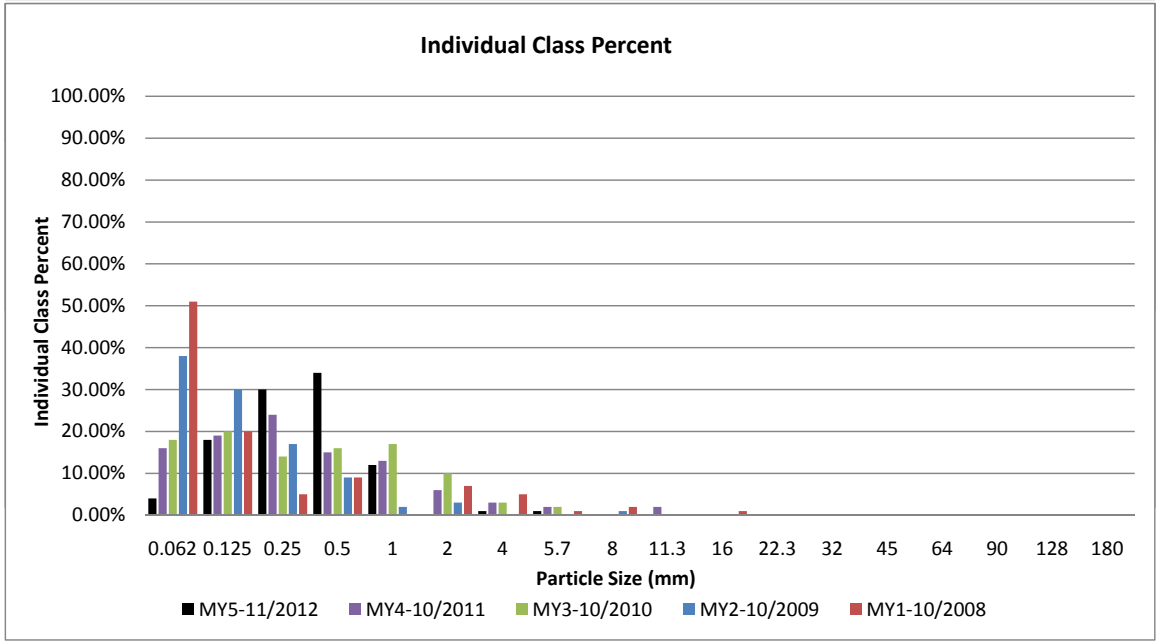




Project Name: East Tarboro Canal Cross Section: 7 Monitoring Year 5 - 2012					
Desc.	**Material**	**Size (MM)**	**Count**	**% of Total**	**Cumulative %**
SAND	silt/clay	0.062	4	4.00%	4.00%
	very fine sand	0.125	18	18.00%	22.00%
	fine sand	0.25	30	30.00%	52.00%
	medium sand	0.5	34	34.00%	86.00%
	coarse sand	1	12	12.00%	98.00%
	very coarse sand	2	0	0.00%	98.00%
GRAVEL	very fine gravel	4	1	1.00%	99.00%
	fine gravel	5.7	1	1.00%	100.00%
	fine gravel	8			
	medium gravel	11.3			
	medium gravel	16			
	coarse gravel	22.3			
	coarse gravel	32			
	very coarse gravel	45			
	very coarse gravel	64			
COBBLE	small cobble	90			
	medium cobble	128			
	large cobble	180			
	very large cobble	256			
BOULDER	small boulder	362			
	small boulder	512			
	medium boulder	1024			
	large boulder	2048			
TOTAL % of whole count:			**100**	**100%**	**100%**

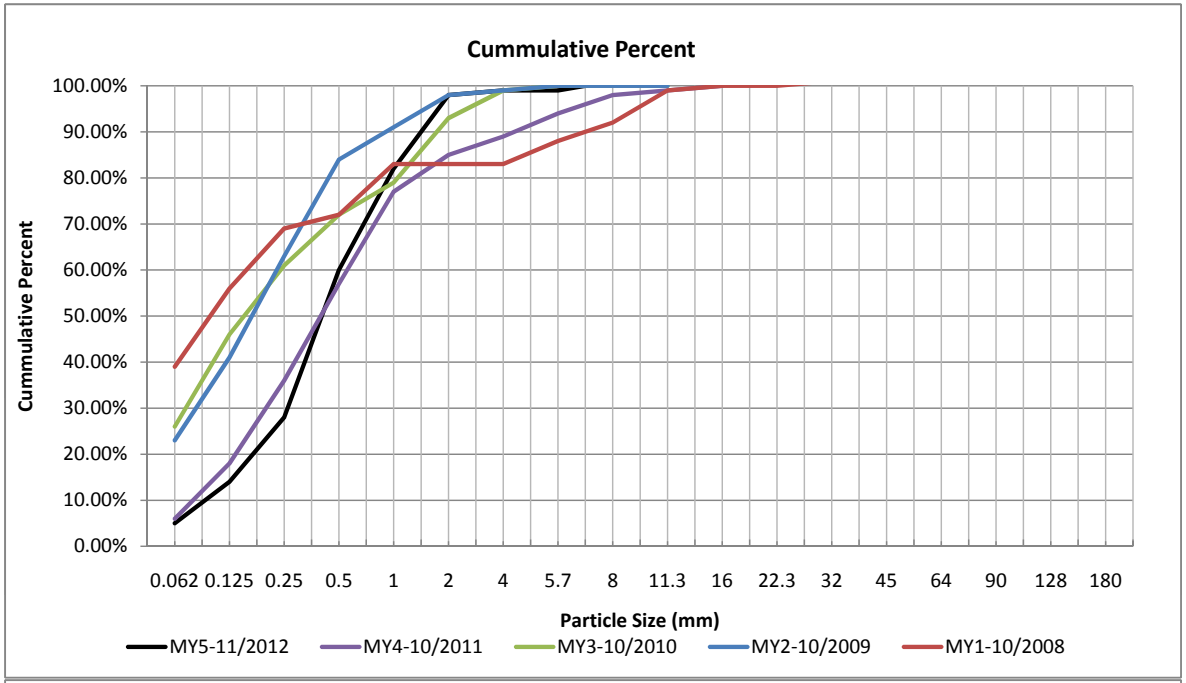
Sumamry Data	
D50	0.24
D84	0.48
D95	0.84

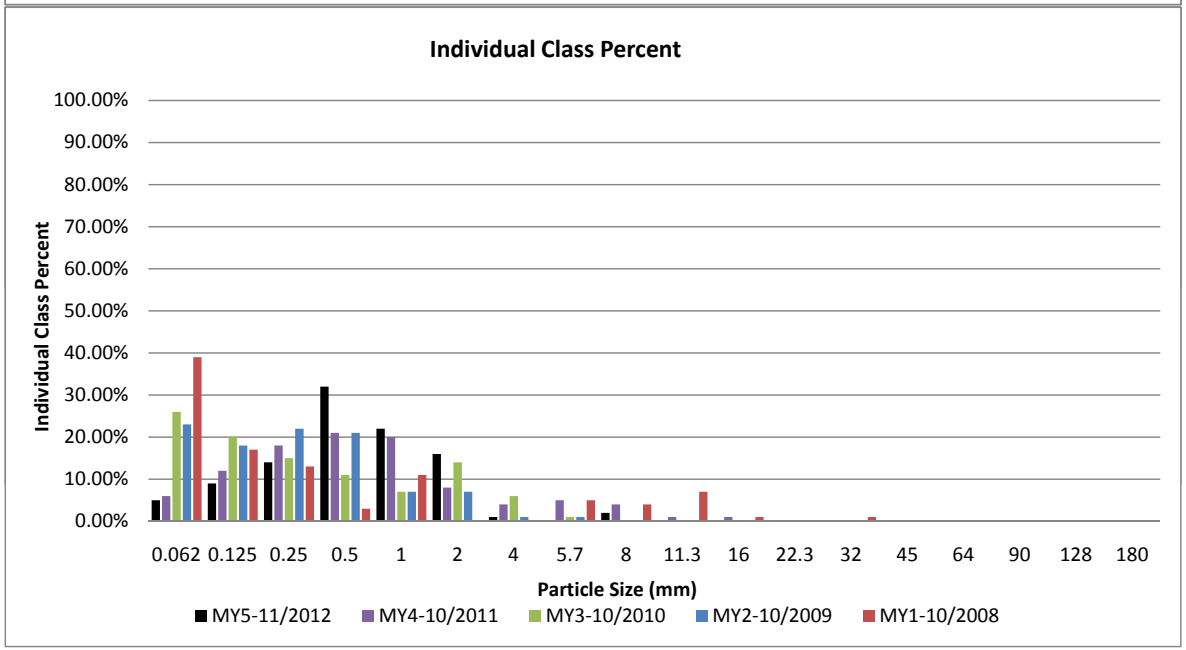




Project Name: East Tarboro Canal Cross Section: 8 Monitoring Year 5 - 2012					
Desc.	**Material**	**Size (MM)**	**Count**	**% of Total**	**Cumulative %**
SAND	silt/clay	0.062	5	5.00%	5.00%
	very fine sand	0.125	9	9.00%	14.00%
	fine sand	0.25	14	14.00%	28.00%
	medium sand	0.5	32	32.00%	60.00%
	coarse sand	1	22	22.00%	82.00%
	very coarse sand	2	16	16.00%	98.00%
GRAVEL	very fine gravel	4	1	1.00%	99.00%
	fine gravel	5.7		0.00%	99.00%
	fine gravel	8	2	2.00%	101.00%
	medium gravel	11.3			
	medium gravel	16			
	coarse gravel	22.3			
	coarse gravel	32			
	very coarse gravel	45			
	very coarse gravel	64			
COBBLE	small cobble	90			
	medium cobble	128			
	large cobble	180			
	very large cobble	256			
BOULDER	small boulder	362			
	small boulder	512			
	medium boulder	1024			
	large boulder	2048			
TOTAL % of whole count:			**101**	**100%**	**100%**

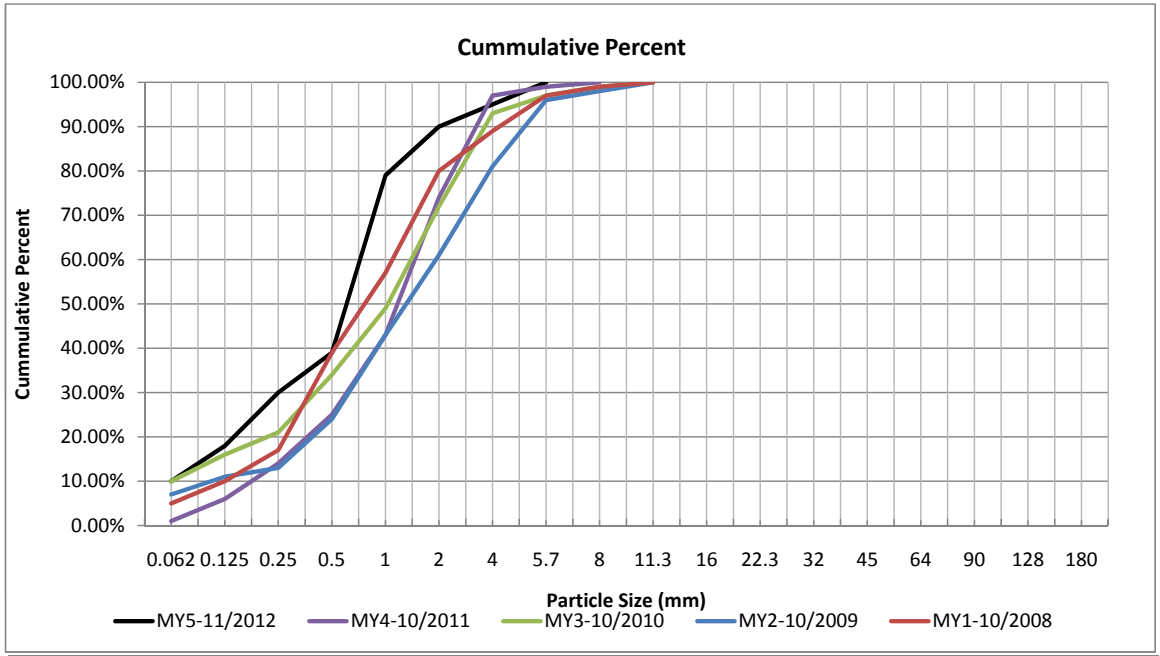
Sumamry Data	
D50	0.41
D84	1.1
D95	1.8

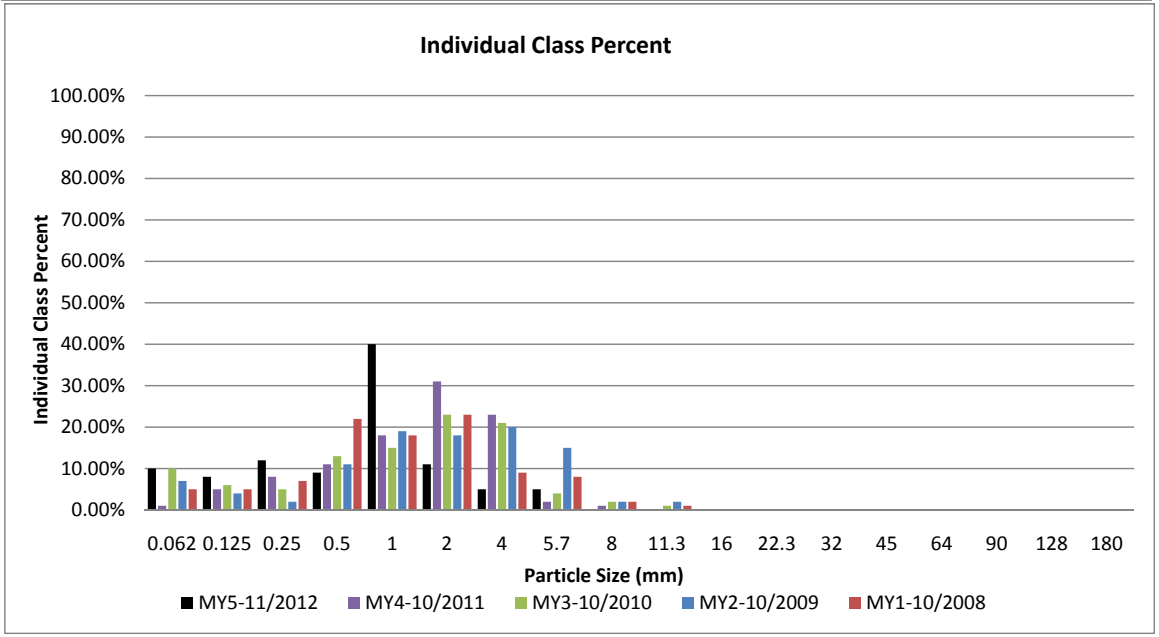




Project Name: East Tarboro Canal Cross Section: 11 Monitoring Year 5 - 2012					
Desc.	**Material**	**Size (MM)**	**Count**	**% of Total**	**Cumulative %**
SAND	silt/clay	0.062	10	10.00%	10.00%
	very fine sand	0.125	8	8.00%	18.00%
	fine sand	0.25	12	12.00%	30.00%
	medium sand	0.5	9	9.00%	39.00%
	coarse sand	1	40	40.00%	79.00%
	very coarse sand	2	11	11.00%	90.00%
GRAVEL	very fine gravel	4	5	5.00%	95.00%
	fine gravel	5.7	5	5.00%	100.00%
	fine gravel	8			
	medium gravel	11.3			
	medium gravel	16			
	coarse gravel	22.3			
	coarse gravel	32			
	very coarse gravel	45			
	very coarse gravel	64			
COBBLE	small cobble	90			
	medium cobble	128			
	large cobble	180			
	very large cobble	256			
BOULDER	small boulder	362			
	small boulder	512			
	medium boulder	1024			
	large boulder	2048			
TOTAL % of whole count:			**100**	**100%**	**100%**

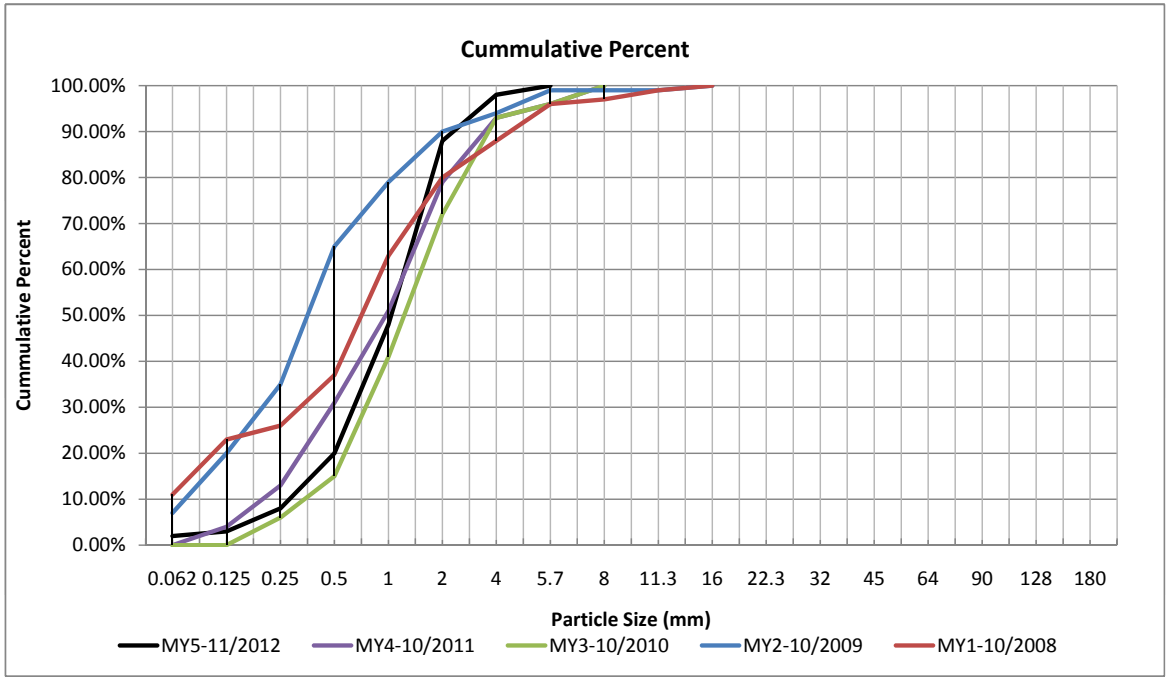
Sumamry Data	
D50	0.6
D84	1.1
D95	4

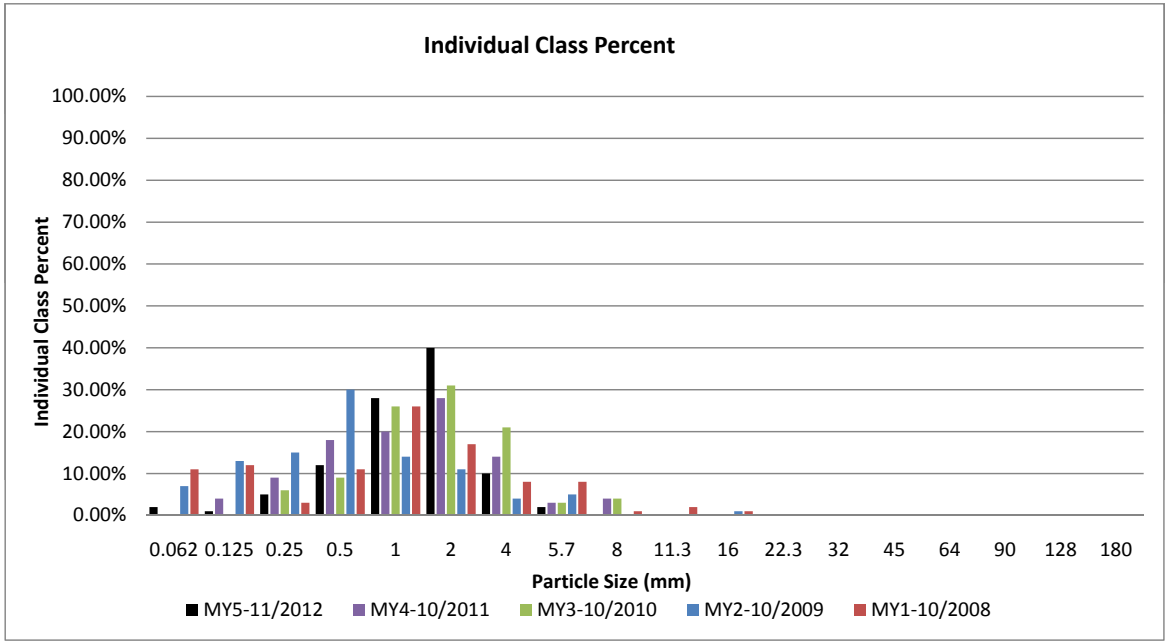




Project Name: East Tarboro Canal Cross Section: 12 Monitoring Year 5 - 2012					
Desc.	**Material**	**Size (MM)**	**Count**	**% of Total**	**Cumulative %**
SAND	silt/clay	0.062	2	2.00%	2.00%
	very fine sand	0.125	1	1.00%	3.00%
	fine sand	0.25	5	5.00%	8.00%
	medium sand	0.5	12	12.00%	20.00%
	coarse sand	1	28	28.00%	48.00%
	very coarse sand	2	40	40.00%	88.00%
GRAVEL	very fine gravel	4	10	10.00%	98.00%
	fine gravel	5.7	2	2.00%	100.00%
	fine gravel	8			
	medium gravel	11.3			
	medium gravel	16			
	coarse gravel	22.3			
	coarse gravel	32			
	very coarse gravel	45			
	very coarse gravel	64			
COBBLE	small cobble	90			
	medium cobble	128			
	large cobble	180			
	very large cobble	256			
BOULDER	small boulder	362			
	small boulder	512			
	medium boulder	1024			
	large boulder	2048			
TOTAL % of whole count:			**100**	**100%**	**100%**

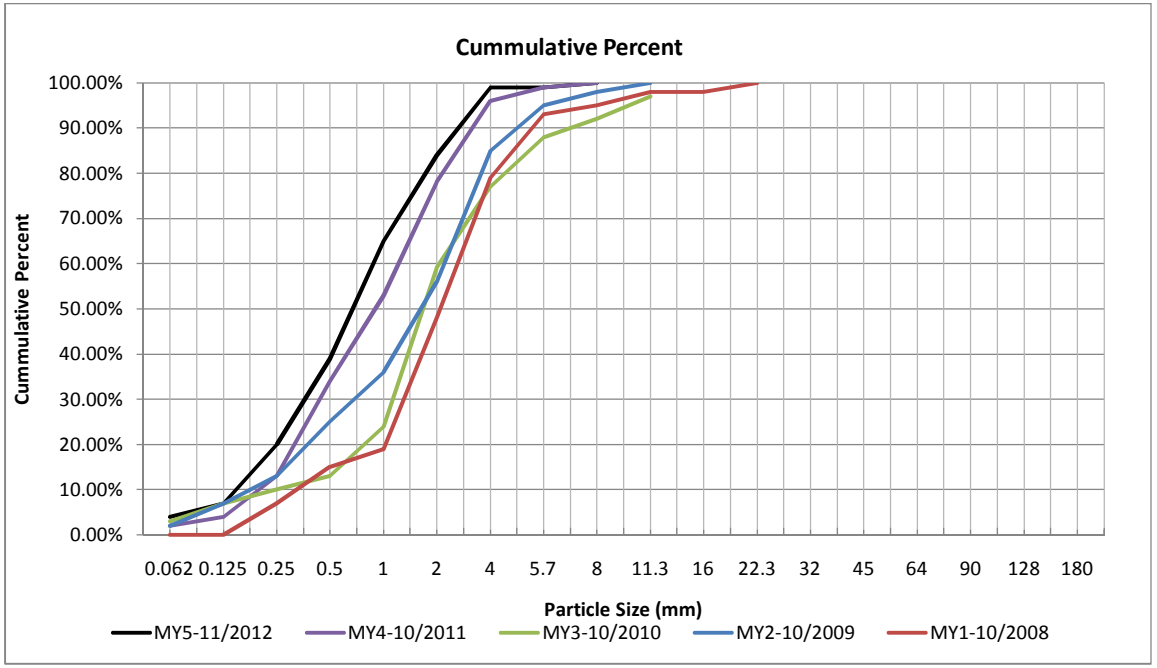
Sumamry Data	
D50	1
D84	1.9
D95	3.2





Project Name: East Tarboro Canal Cross Section: 13 Monitoring Year 5 - 2012					
Desc.	**Material**	**Size (MM)**	**Count**	**% of Total**	**Cumulative %**
SAND	silt/clay	0.062	4	4.00%	4.00%
	very fine sand	0.125	3	3.00%	7.00%
	fine sand	0.25	13	13.00%	20.00%
	medium sand	0.5	19	19.00%	39.00%
	coarse sand	1	26	26.00%	65.00%
	very coarse sand	2	19	19.00%	84.00%
GRAVEL	very fine gravel	4	15	15.00%	99.00%
	fine gravel	5.7	0	0.00%	99.00%
	fine gravel	8	1	1.00%	100.00%
	medium gravel	11.3	0	0.00%	
	medium gravel	16	0	0.00%	
	coarse gravel	22.3	0	0.00%	
	coarse gravel	32	0	0.00%	
	very coarse gravel	45	0	0.00%	
	very coarse gravel	64	0	0.00%	
COBBLE	small cobble	90	0	0.00%	
	medium cobble	128	0	0.00%	
	large cobble	180	0	0.00%	
	very large cobble	256	0	0.00%	
BOULDER	small boulder	362	0	0.00%	
	small boulder	512	0	0.00%	
	medium boulder	1024	0	0.00%	
	large boulder	2048	0	0.00%	
TOTAL % of whole count:			**100**	**100%**	**100%**

Sumamry Data	
D50	1
D84	2
D95	3.3



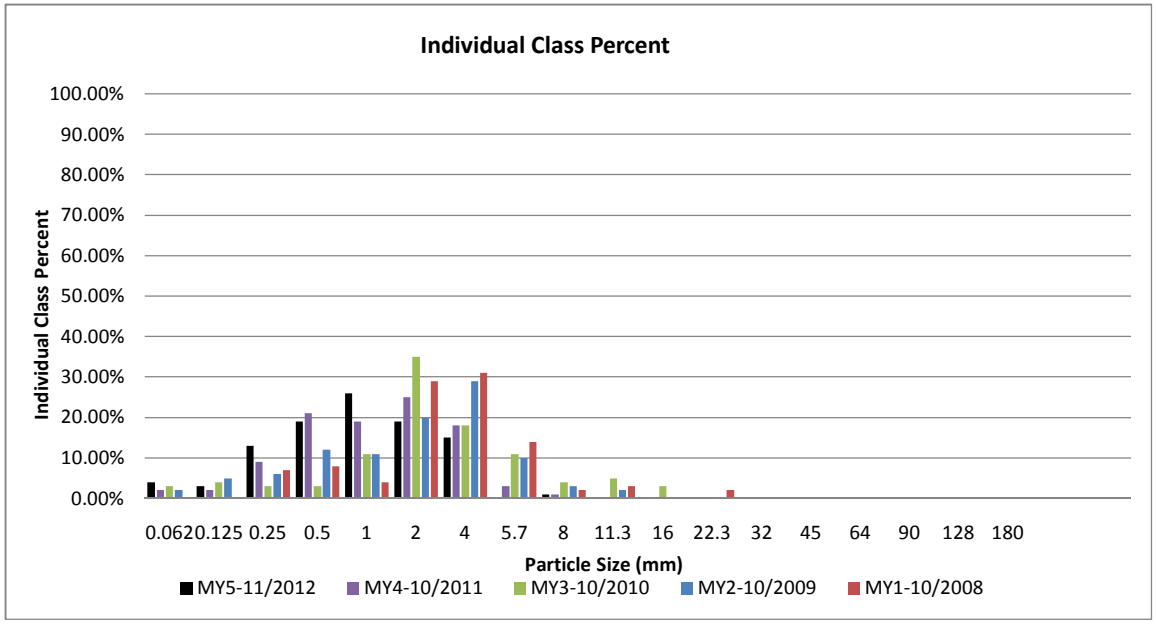


Table 10a. Baseline Stream Data Summary
East Tarboro Canal Stream Restoration Site - EEP Project No. 123
Reach 2 (2989 feet)

Parameter	USGS Gage Data			Regional Curve Interval			Pre-Existing Condition			Project Stream Reference			Design			As-Built		
Dimension	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
BF Width (ft)						14.55	14	17	15	10.8	11	10.9	Na	Na	20	17.66	30.32	20.6
Flood Prone Width (ft)						24.34	22.8	25.4	24.1	8.3	9.6	9	Na	Na	29.25	20.52	31.22	26.73
BF Cross Sectional Area (SF)						1.63	1.5	1.72	1.61	0.77	0.87	0.82	Na	Na	1.46	.89	1.41	1.25
BF Mean Depth (ft)							2.2	2.37	2.32	1.24	1.45	1.34	Na	Na	2.5	1.75	3.5	2.69
BF Max Depth (ft)							8.2	11.4	9.4	12.6	14.1	13.4	Na	Na	13.7	13.23	34.07	16.22
Width/Depth Ratio							1.5	1.7	NA	9.1	9.3	Na	2.2	6	Na	1.75	5.52	4.65
Entrenchment Ratio							17.6	31.1	21.75	Na	Na	Na	Na	Na	Na	19.2	30.78	21.88
Bank Height Ratio							.87	1.36	1.14	Na	Na	Na	Na	Na	Na	0.88	1.29	1.19
Wetted Perimeter (ft)																		
Hydraulic Radius (ft)																		
Pattern																		
Channel Beltwidth (ft)							29	47	39	12.5	25	18.8	22	46	34	20.58	52.64	36.53
Radius of Curvature (ft)							75	560	220	14.4	39.8	23.3	40	72	56	22.99	71.49	37.54
Meander Wavelength (ft)							154	226	190	39	64	50.4	72	170	Na	100.91	147.43	129.22
Meander Width ratio							10.3	15.1	12.7	3.6	5.9	4.6	1.1	2.3	1.7	0.374	0.956	0.663
Profile																		
Riffle Length							Na	Na	Na	Na	Na	Na	Na	Na	Na	Na	Na	64.25
Riffle Slope							.002	.0044	.0002	0	.0055	.0022	0	.0036	Na	Na	Na	.00543
Pool Length							Na	Na	23.3	Na	Na	13	Na	Na	24	49.66	113.74	70.29
Pool Spacing							44	133	90	16	45	32.3	32	86	59	72.09	416.51	206.2
Substrate																		
d50 (mm)																.05	2	1.14
d84 (mm)																1.88	18.06	4.49
Additional Reach Parameters																		
Valley Length (ft)									2722						2722			2722
Channel Length (ft)									2946			280			2946			2946
Sinuosity									1.03			1.3	1.2	1.4	1.1			1.19
Water Surface Slope									.0007	0	.0055	.003	0	.0036				.00185
BF Slope							0	.0044	Na			Na			Na			.00179
Rosgen Classification									G5c			C5			C5			C5
*Habitat Index																		
*Macrobenthos																		

Table 11a. Morphology and Hydraulic Monitoring Summary*
East Tarboro Canal Stream Restoration Site - EEP Project No. 123
Reach 2 (2989 LF)

Parameter	Cross Section 6						Cross Section 7						Cross Section 8						Cross Section 9**						Cross Section 10**					
Based on fixed baseline bankfull elv.	MY0	MY1	MY2	MY3	MY4	MY5	MY0	MY1	MY2	MY3	MY4	MY5	MY0	MY1	MY2	MY3	MY4	MY5	MY0	MY1	MY2	MY3	MY4	MY5	MY0	MY1	MY2	MY3	MY4	MY5
Record elevation (datum) used	35.94	35.98	35.9	35.94	35.94	35.94	36.1	35.9	35.8	36.1	36.1	36.1	35.98	35.7	36	35.98	35.98	35.98	34.24	34.3	34.3	34.24	34.24	34.24	33.76	33.7	33.7	33.76	33.76	33.76
Bankfull Width (ft)	30.32	36.6	35.51	35.8	34.3	30.7	22.54	26.8	23.54	92.2	34.3	31.9	20.6	12.7	15.13	62.6	52.4	57.8	19.36	34.7	14.0	29.7	20.02		20.6	22.7	19.52	72	63.5	
Floodprone Width (ft)	100	115	99.1	101	99.6	100	100	85.5	63.4	101.8	99.3	100.4	75	51.7	69.5	74.5	74.2	76.5	101.4	78.6	87.4	99	97.9		100	92.4	98.8	101.1	103.4	
Bankfull Mean Depth (ft)	0.89	.67	0.72	0.8	.55	0.7	1.39	1.1	0.83	0.7	1.1	0.8	1.12	0.95	0.95	0.7	0.6	0.6	1.41	0.5	1.7	1.8	2.2		1.25	0.95	1.02	0.4	0.4	
BF Cross Sectional Area(ft)	26.95	24	25.46	27.2	18.7	20.4	31.22	30	19.6	66.7	38.6	26.2	22.99	12.1	14.30	44.6	29.6	32.4	27.34	22.19	23.3	52.6	44.5		25.78	21.6	19.96	27.5	26.5	
BF Width/Depth Ratio	34.07	55.7	49.5	47.0	62.8	46	16.22	23.9	29	127.5	30.6	39	18.39	13.3	16.0	87.9	92.8	103.3	13.73	66.9	8.4	16.8	9		16.48	23.8	19.1	188.7	152.2	
BF Entrenchment Ratio	3.3	3.1.1	0.7	2.8	2.9	3.3	4.44	3.2	2.6	1.1	2.9	3.1	3.64	4.1	4.6	1.2	1.4	1.3	5.24	12.3	6.3	3.3	4.9		4.85	4.1	5.1	1.4	1.6	
BF Bank Height Ratio (ft)	1.15	1.13	1.2	1	1.03	0.8	1.04	1.04	1.04	1.03	1.03	1	0.97	1.05	1.04	1.03	1.04	0.7	0.92	1.03	0.99	1.03	0.98		1.04	1	0.99	1	0.99	
Hydraulic radius (ft)	0.9	0.7	0.7	0.8	0.5	0.6	0.8	1	0.7	0.7	1	0.8	1.1	0.8	0.9	0.7	0.5	0.5	0.6	1	1.5	1.6	0.5		1	0.9	1.0	0.4	0.4	
Cross Sectional Area between Bank Pins ft)	40.9	43.7	39.1	43.9	46.4	32.8	44.8	45.8	59.4	80.2	69.3	189	24.4	35	37.4	47.9	32.2	63.5	31.2	49.8	51.8	53.2	45.4		26.2	26	23.4	28.9	37.2	
D50 (mm)	1.05	0.67	0.16	0.4	0.45	0.59	0.05	.062	.082	0.23	0.19	0.24	0.05	0.1	.17	0.062	0.4	0.41	1.95	1.7	1.2	0.4	0.54		2	2	1.6	1.2	1	
Parameter	**Cross Section 11**						**Cross Section 12**						**Cross Section 13**																	
Based on fixed baseline bankfull elv.	MY0	MY1	MY2	MY3	MY4	MY5	MY0	MY1	MY2	MY3	MY4	MY5	MY0	MY1	MY2	MY3	MY4	MY5												
Record elevation (datum) used	33.06	33	33.16	33.06	33.06	33.06	32.76	32.6	32.61	32.76	32.76	32.76	31.92	31.84	31.47	31.92	31.92	31.92												
Bankfull Width (ft)	18.93	15.1	18.77	39.9	47.2	49.6	18.13	15.6	17.98	55.9	31.9	69.8	21.52	9.6	10.99	34.2	36.4	26.7												
Floodprone Width (ft)	100	97.3	93.2	101.7	90	100.7	100	89.5	82.6	102.7	69.7	100.7	100	38	47.1	0.7	66.7	103												
Bankfull Mean Depth (ft)	1.41	1.2	0.96	0.8	0.7	0.8	1.37	0.8	0.79	0.6	0.9	0.4	1.24	1.4	1.04	0.7	0.8	1												
BF Cross Sectional Area(ft)	26.71	18.2	18.01	32.6	33.8	38.9	24.83	12.9	14.28	34.2	27.4	31.3	26.73	13.5	11.43	25	29.3	25.7												
BF Width/Depth Ratio	13.43	12.6	19.5	48.9	66.1	63.2	13.23	18.9	22.6	91.4	37.3	155.6	17.35	6.9	10.6	46.8	45.1	27.8												
BF Entrenchment Ratio	5.28	6.4	5.3	2.5	1.9	2	5.52	5.7	4.6	1.8	2.2	1.4	4.65	3.9	4.3	3.0	1.8	2.7												
BF Bank Height Ratio (ft)	1	1.27	1.05	1	0.83	0.9	1.05	1.05	0.97	0.86	0.95	0.9	0.99	1.05	1.04	0.96	1	1												
Hydraulic radius (ft)	1.28	1.1	0.9	0.8	0.7	0.8	1.29	0.8	0.7	0.6	0.7	0.4	1.15	1.1	0.9	0.7	0.7	0.9												
Cross Sectional Area between Bank Pins ft)	81.8	62.1	96.5	97.8	95.8	86.7	62.8	45.4	66.3	62.6	73.9	42.6	52.5	42.9	58.4	53.9	65.4	99.1												
D50 (mm)	N/A	0.76	1.3	1	1	0.6	1.14	0.71	.35	1.2	0.97	1	1.97	2.1	1.6	1.7	0.9	1												

* Cross Sections 1 through 5 are located on Reach 1. Reach 1 and all Reach 1 assets have been removed from the East Tarboro Canal Stream Restoration Project.
**Cross Sections 9 and 10 were not surveyed for MY5 2012 due to beaver dam ponding.

Exhibit Table 11b. Monitoring Data – Stream and Data Summary
East Tarboro Canal Stream Restoration Site - EEP Project No. 123
Reach 2 (2989 LF)

Parameter	Baseline						MY-01 (2008)						MY-02 (2009)						MY-03 (2010)						MY-04 (2011)						MY-05 (2012)					
Dimension and Substrate*	Min	Mean	Med	Max	SD4	N	Min	Mean	Med	Max	SD4	N	Min	Mean	Med	Max	SD4	N	Min	Mean	Med	Max	SD4	N	Min	Mean	Med	Max	SD4	N	Min	Mean	Med	Max	SD4	N
Bankfull Width (ft)	17.66		20.6	30.32			9.6	21.73	19.15	30			10.99	19.43	18.37	25.46			29.7	50.85	50.5	72			20.02	40	35.35	44.5			26.7	44.42	40.75	57.8		
Floodprone Width (ft)							38	81	87.5	115			47.1	80.13	85	99.1			74.5	88.6	96.7	102.7			69.7	91.76	98.6	103.4			76.5	96.88	100.55	103.4		
BF Mean Depth (ft)	1.46		1.25	1.41			0.5	0.95	0.95	1.4			0.72	1	0.95	1.7			0.4	1.1	0.73	1.8			0.4	0.88	0.7	2.2			0.4	0.72	0.75	1		
BF Max Depth (ft)	2.5		2.69	3.5			1.6	3.06	2.9	4.9			1.54	2.65	2.63	3.72			1.9	3.3	3.2	4.7			1	2.96	3.2	3.7			1.8	2.46	2.6	3.7		
BF Cross Sectional Area (ft2)	20.52		26.73	31.22			12.1	19.31	19.9	30			11.43	18.29	18.80	25.46			29.7	60.95	55.4	92.2			18.7	31.05	29.45	44.5			20.4	29.15	28.75	38.9		
Width/Depth Ratio (ft)	13.23		16.22	34.07			6.9	27.75	21.35	66.9			8.4	21.83	19.3	49.5			16.8	102.75	70.4	188.7			9	61.98	53.95	152.2			27.8	72.48	54.60	155.6		
Entrenchment Ratio (ft)	1.75		5.52	4.65			3.1	14.04	4.1	12.3			0.7	12.63	4.6	6.3			1.4	3.05	3.2	4.7			1.4	17.73	2.05	4.9			1.3	2.30	2.35	3.3		
Bank Height Ratio (ft)							1	1.08	1.05	1.27			0.97	1.04	1.04	1.2			0.86	0.99	1	1.03			0.83	0.98	0.99	1.04			0.7	0.88	0.90	1		
Profile																																				
Riffle Length (ft)			64.25					71.44						68.91						58.9						96.7					72.05					
Riffle Slope (ft)			.00543					.006						.0065						.0062						.0083					.0078					
Pool Length (ft)			70.29					135.2						148.7						153.3						133.3					142.6					
Pool Max Depth (ft)																																				
Pool Spacing (ft)			206.2					157.8						149.6						148.9						182.9					153.2					
Rosgen Classification			C5					C5						C5						C5						C5					C5					
*Habitat Index																																				
Pattern																																				
Channel Beltwidth (ft)	20.58		36.53	52.64																																
Radius of Curvature (ft)	22.99		37.54	71.49																																
Rc: Bankfull width (ft/ft)																																				
Meander Wavelength (ft)	100.91		129.22	147.32																																
Meander Width Ratio	0.374		.663	0.956																																
Additional Reach Parameters																																				
Rosgen Classification		C5						C5						C5						C5						C5						C5				
Channel Thalweg length (ft)		2933						2933						2933						2993						2993						2993				
Sinuosity		1.19						1.19						1.19						1.19						1.19						1.19				
Water Suface Slope (Channel) (ft/ft)		.00185						.0116						.0021						.00205						.00239						.00212				
BF Slope (ft/ft)		.00179						.0020						.0020						.00187						.00240						.0019				
Ri% / Ru% / P% / G% / S%																																				
SC% / Sa% / G%/ C% / B% / Be%																																				
D16 /d35 / d50 / d84 / d95																																				
% Reach with Eroding Banks																																				
Channel Stability or Habitat Metric																																				
Biological or Other																																				

APPENDIX E

Verification of Bankfull Events

Table 12. Verification of Bankfull Events			
Date of Data Collection	**Date of Occurrence**	**Method**	**Photo#**
11/16/2012	October 2012	Photo of wrack line right side of picture	Photo Station 5 Appendix B